

# MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

NOVEMBER, 1889.

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1889.

list of merchant marine steam and sailing vessels from which International Meteorological reports were received at the office of the Chief Signal Officer, U. S. Army, Washington City, in time to be used in the preparation of the Monthly Weather Review for November, 1889.

	Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.		
Am.	s. s. Adirondack	J. Sansom.	Br.	s. s. Historian	R. Buddie.	Br.	s. s. Scandinavian	J. Park.
Br.	Adriatic	J. G. Cameron.	Br.	Holland	Thos. Footo.	Br.	Seythia	T. Roberts.
	Advance	D. E. Griffiths.	Br.	Horrox	T. Henning.	Am.	Senea	F. Stevens.
	Ailes	J. W. Morris.	It.	Huntingdon	R. Leng.	Br.	Servia	H. Walker.
Am.	Alaska	G. S. Murray.	Br.	Initiativa	A. Consoneri.	Br.	Siberian	R. P. Moore.
Ger.	Algiers	F. W. Mason.	Dan.	Iowa	E. W. Owens.	Nor.	Sicilia	W. R. Pridaux.
Br.	Allamandine	H. Christoffers.	Br.	Island	W. Skjold.	Br.	Sif	H. Bentzon.
	Alvina	C. S. Collings.		Istrian	A. W. Ball.		Spain	W. A. Griffiths.
Ger.	Aivo	F. McKay.		Italy	W. Pearce.		State of Nebraska	A. G. Braes.
Dtch.	America	David Williams.	Am.	Ixia	Wm. Churnside.		State of Pennsylvania	A. J. A. Mann.
Br.	Amsterdam	A. Kohlmann.	Fr.	Kansas	A. Fenton.		State of Texas	G. Williams.
	Anchoria	G. Stenger.	Br.	Kate Fawcett	C. F. Young.		Stockholm City	W. Thompson.
	Angers	A. Campbell.		Kepier	M. Fleet.	Ger.	Suevia	C. Ludwig.
	Antilles	James Pinkham.	Am.	Knickerbocker	F. Kimble.	Br.	Suppeich	L. Y. Gillan.
	Ardangorm	A. Cary.	Fr.	La Bourgogne	E. Franguel.		Switzerland	J. Ueberweg.
	Ardanrigh	H. Cameron.	Br.	La Bretagne	M. de Jousselin.	Br.	Teutonic	H. Parsell.
	Arizonas	W. Anderson.		La Champagne	Boyer.	Dan.	Thanemore	A. J. Baxter.
	Ascania	S. Brooks.	Br.	La Flandre	E. Smit.	Br.	Thingwalla	S. T. H. Laub.
	Athos	P. Froelich.		La Gascogne	Santelli.	Ger.	Tower Hill	R. P. Bennett.
	Augusta Victoria	H. Low.	Br.	La Nepon	H. Hellmers.	Br.	Trave	W. Willigerod.
Ger.	Aurania	A. Albera.		Lake Ontario	C. F. Herriman.		Trinidad	J. S. Garvin.
Br.	Author	H. McKay.	Am.	Lake Superior	H. Campbell.		Ulunda	T. Clark.
	Baltimore	R. Owen.	Br.	Lake Winnipeg	W. M. Stewart.		Umbria	W. McMickan.
	Baumwall	C. J. Simpson.		Llandaff City	F. Carey.		Vancouver	T. Evans.
Ger.	Bayarian	W. H. Moore.	Br.	Lord Clive	T. H. Gore.		Veendam	C. J. Lindall.
Br.	Bayonne	C. W. Rhea.		Lord Gough	P. Urquhart.	Ger.	Venetian	A. J. Potjer.
	Belgenland	M. Fitt.	Br.	Lord O'Neill	E. M. Hughes.	Br.	Venice	E. Parry.
Belg.	Bengore Head	J. E. Payne.		Louisiana	A. Ferris.		Viola	A. B. Bolt.
	Benito Estenger	R. Weyer.	Am.	Ludgate Hill	E. V. Gager.		Virginian	L. Murray.
Span.	Bohemia	D. Smith.	Br.	Main	J. Brown.		Wallachia	W. C. Fry.
Ger.	Borderer	E. F. Canal.		Maine	M. Moller.		Werra	W. Croskery.
Br.	Bracadaile	G. Theile.	Br.	Manitoban	H. Bocquet.		Westerland	R. Bussius.
	Brandenburg	F. Manley.		Mareca	J. M. Johnstone.		Wieland	H. Roch.
	Britannic	W. Ward.	Br.	Martello	L. O. Moon.		Wisconsin	J. C. Jamison.
	British King	S. Roach.		Maryland	Wm. Abbott.		Wylo	J. W. Harrison.
	British Prince	H. Davison.		Mascotte	A. H. Luckhurst.		Wyoming	C. Kaempff.
	British Princess	John Kelly.		Mentmore	Jas. Ross.	United States Naval.		J. P. Worrall.
	Brooklyn City	S. Nowell.		Militiades	R. Waite.	U. S. C. B. A. D. Bache		T. Rogers.
	Bulgarian	E. H. Freeth.		Michigan	R. H. Vincent.	U. S. C. G. S. Blake		C. L. Rigby.
	California	W. F. Fitt.		Minneola	S. Walters.	U. S. S. Chicago		J. F. Moser.
	California	R. Leask.		Minia	T. L. Evans.	U. S. S. Despatch		J. E. Pillsbury.
	Carroll	R. Baur.		Missouri	S. Trott.	U. S. S. Dolphin		H. B. Robeson.
	Caspian	R. T. Garvie.		Montana	H. Murrell.	U. S. C. & G. S. schr. Ernest		W. S. Cowles.
	Catalonia	J. W. Pickthall.		Moravia	W. H. Williams.	U. S. C. & G. schr. Egare		Chas. O'Neil.
	Cephalonia	G. H. Brown.		Muriel	G. Winkler.	U. S. C. S. Gedney		J. N. Jordan.
Am.	Chalimette	A. McDougall.		Naranja	G. S. Locke.	U. S. R. S. Independence		W. P. Elliott.
Fr.	Chateau Ladie	J. J. Atkin.		Nederland	J. Scilly.	U. S. C. & G. S. McArthur		J. M. Helm.
Am.	Charles Morand	J. B. Watt.		Neasmorre	E. Bence.	U. S. S. New Hampshire		J. W. Philip.
Br.	Circassia	Geo. Mason.		Neastorian	G. Elliott.	U. S. S. Ossipee		D. H. Mahan.
Am.	City of Alexandria	M. C. Olliver.		Neustria	J. France.	Sailing vessels.		J. F. Higginson.
Br.	City of Augusta	W. H. Marshall.		Nevada	P. Verries.	Br.	bk. Adamantine	F. H. Delano.
Br.	City of Berlin	H. A. Bearse.		New Orleans	J. A. R. Cushing.	Am.	bk. Adalbert	J. Clark.
	City of Chicago	J. Harris.		Noordland	T. P. C. Halsey.	Am.	bk. Adalbert	W. B. Henrhan.
	City of New York	J. W. Catherine.		Norrone	H. E. Nickels.	Br.	bk. Adalbert	S. M. Ritchie.
Am.	City of Para	J. McIntosh.		North Erin	J. J. Isaakjen.	Br.	bk. Adalbert	J. W. Emmons.
Br.	Claribel	J. W. Lewis.		Northgate	R. Williams.	Br.	bk. Adalbert	E. Low.
	Collina	J. L. Lockwood.		Norwegian	W. Ramsdale.	Br.	sp. City of Baltimore	L. S. Tawes.
Am.	Colorado	Thos. McKnight.		Nueces	W. Christie.	Br.	sp. City of Hanhow	J. King.
Br.	Cornucopia	R. C. Jennings.		Nurnberg	Sam Risk.	Am.	sp. City of Hanhow	F. Wyman.
	Crystal	F. E. Jenkins.		Oceanic	H. Engelbart.	Br.	sp. City of Hanhow	J. R. Shillaber.
	Cufe	G. Smith.		Ohio	C. H. Kempson.	Am.	sp. Eclipse	S. D. Mason.
	Dalton	R. B. Stannard.		Ontario	R. W. Sargent.	Br.	sp. Eclipse	W. B. Kreger.
	Denmark	H. Nicol.		Ornunmore	W. P. Couch.	Br.	sp. Florence Randall	J. L. Randall.
	Devonia	J. Russell.		Oregon	B. Jones.	Br.	sp. Garfield	H. B. Conby.
	Dunmore Head	R. S. Bigby.		Orinoco	H. C. Williams.	Am.	bk. Gertrude	B. H. Cox.
	Earnwell	Jno. Craig.		Osmanni	J. S. Garvin.	Br.	bk. Gertrude	W. S. Hasche.
	Edwin	J. Auld.		Othello	C. O'Hagan.	Br.	bk. Golden Sheaf	W. Chandler.
	Egypt	W. H. Carter.		Palestine	H. Mundt.	Am.	bk. Henry Stewart	W. F. Blake.
	Eider	W. T. Stacey?		Parisian	W. Whiteaway.	Br.	bk. Hussey	G. W. Hodgeson.
	Elgiva	J. Summer.		Pavonia	J. Bitchie.	Am.	bk. Henry A. Faber	H. E. Garlick.
	El Monte	H. Baur.		Perak	A. McKay.	Br.	bk. Henry Warner	J. T. Paine.
	El Paso	B. R. Quick.		Pennland	W. Ponson.	Am.	bk. Hope	G. W. David.
Ger.	Ems	H. S. Quick.		Pennsylvania	H. Buschmann.	Br.	bk. Hope	N. Olsen.
It.	Entelia	T. Jungot.		Peruvian	E. B. Thomas.	Br.	Imacos	G. E. Barker.
Br.	Erato	V. Bruno.		Pocahontas	J. W. Wallace.	Br.	Jennie Parker	J. McCarthy.
	Ethiopia	F. Simmons.		Polaris	J. James.	Am.	John B. Bergen	F. D. Vieira.
	Etruria	W. Tyson.		Polynesia	F. Schrour.	Br.	pilot Joseph F. Loubat	J. P. Stowers.
Am.	Excelsior	John Wilson.		Ponca	G. Franck.	Port.	bk. Julius	J. P. Stowers.
Br.	Federation	W. H. P. Hains.		Powhatan	J. Edwards.	Am.	Kennard	J. F. Grindel.
	France	H. L. Higgins.		Prins Fred. Hendrik	J. F. Dorr.	Br.	bk. Light vessel No. 45	D. W. Oliver.
	Fulda	R. Pinkham.		Prins Regent	F. F. Herwig.	Am.	bk. Otello	J. R. Conroy.
	Galileo	A. D. Hadley.		Prussian	J. Ambury.	Br.	bk. Pallas	M. J. Bond.
	Gellert	R. Ringk.		Professor	G. H. Keller.	Am.	bk. Peppina	J. H. Stege.
	Germanic	W. Magee.		Rhaetia	H. Vogelgesang.	Br.	bk. Qvos	F. Janello.
	Gleadowe	C. Kaempff.		Rhein	W. Kuhliann.	Am.	bk. R. Dudley	G. Olsen.
	Gloucester City	H. Davison.		Rhynland	A. J. Griffin.	Br.	bk. Nutwood	L. P. Jorgenson.
	Gluckauf	O. H. Bonnen.		Richmond	E. S. Clapp.	Am.	bk. Saranac	W. Peterson.
	Godfrey	R. Jones.		Roman	D. Maddox.	Br.	bk. Hubbard	A. F. Pillsbury.
	Gothia	V. Symanski.		Rosarian	D. McKillop.	Br.	bk. Sodium	A. Mehaffy.
	Grecian	W. H. Jamieson.		Rotterdam	H. C. v. d. Zoo.	Am.	Taria Topan	W. Mansan.
	Greece	A. Kuhn.		Seale	R. Karlowa.	Br.	bk. T. Towner	E. B. Trumbull.
	Hammoria	C. E. Le Gallais.		Saint Bonans	H. Bichter.	Br.	bk. Ubaldiana	H. B. Ryder.
	Helvetia	A. J. Jeffrey.		Salerno	H. Campbell.	Br.	bk. Wm. F. Green	C. E. Dayton.
	Hermann	G. Cochrane.		Samaria	B. H. Rogers.	Br.	bk. Wm. H. Diets	H. F. Schive.
	Hindoo	D. Myer.		Santiago	T. Hewitson.	Br.	bk. Wm. Wilson.	W. E. Crockett.
		Jas. Douglas.		Santiago	J. Allen.		sch. Thomas P. Ball	D. B. Darrn.
				Santiago	R. Potter.		bk. Wm. F. Green	C. S. Powell.
				Sardinian	W. Richardson.		sch. Wm. H. Diets	
				Sarmia	J. Gibson.		sch. Wm. Wilson.	

# UNITED STATES SIGNAL SERVICE

## MONTHLY WEATHER REVIEW.

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### INTRODUCTION.

This REVIEW is based on reports for November, 1889, from 2,217 regular and voluntary observers in the United States and Canada. These reports are classified as follows: 177 reports from Signal Service stations; 120 monthly reports from United States Army post surgeons; 1,407 monthly reports from state weather service and voluntary observers; 17 reports of rainfall observations in Arizona furnished by the United States Geological Survey; 25 reports from Canadian stations; 168 reports through the Central Pacific Railway Company; 303 marine reports through the co-operation of the Hydrographic Office, Navy Department; marine

reports through the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, North and South Dakota, Illinois, Indiana, the Iowa Weather Crop Bulletin Service, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Meteorological Report of the Missouri State Board of Agriculture, Nebraska, Nevada, New England, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, and Texas, and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

### CHARACTERISTICS OF THE WEATHER FOR NOVEMBER, 1889.

The most important storm of the month over the eastern part of the country appeared on the Texas coast on the morning of the 26th, whence it moved northeastward to the lower lake region by the 27th, attended in the Mississippi and Missouri valleys by rain or snow. During the 27th and 28th the storm increased in strength and swept eastward over the lower lake region, New York, and the Saint Lawrence Valley, attended by snow in the Lake region and the Ohio Valley and Tennessee, heavy rain in New York and New England, destructive gales on the lakes and in the Saint Lawrence Valley and New England, and a heavy snow storm, the first of the season, in the Province of Quebec. A notable feature for November was the heavy snow storm which prevailed in northeastern New Mexico, extreme northern Texas, southwestern Kansas, and southeastern Colorado during the early part of the month. This storm was accompanied by high wind and low temperature and occasioned loss of life and considerable destruction of live stock. Destructive local storms, resulting in loss of life and damage to property, were reported at New Berne, N. C., on the 21st, and in the northern part of Beaufort county, N. C., on the 28th. The severest storms on the north Atlantic Ocean prevailed over and near the Banks of Newfoundland from the 11th to 13th, and over mid-ocean on the 14th, when gales of hurricane force were reported.

The highest temperature reported was 94°, at Casa Grande, Ariz., and Smithville, Ga., and the lowest temperature reported was -28°, at Fort Buford, N. Dak. At Savannah, Ga., Jacksonville, Fla., Vicksburg, Miss., Fort Canby and Neah Bay, Wash., and Astoria, Oregon, the maximum temperature was as high or higher than previously reported for November, and at Augusta, Ga., Lava, N. Mex., and Fort Thomas, Ariz., the minimum temperature was as low or lower than noted for the corresponding month of preceding years. The month was warmer than the average November in the Lake region, upper Ohio valley, northern Minnesota, Canada, the Atlantic coast states, the plateau and Rocky Mountain regions west of the one hundred and tenth meridian, and on the Pacific coast;

elsewhere the weather was cooler than usual. In districts where the temperature was above the average the departures were less than 5°, while in central Texas and central Colorado the departures below the average temperature for November exceeded 5°. At Newburyport and Somerset, Mass., Orono, Me., and Eola, Oregon, the average temperature was the highest ever reported for November, and at Lead Hill, Ark., and Grand Coteau, La., the November, 1889, average temperature was lower than reported for the corresponding month of preceding years. For the period January 1 to November 30, 1889, inclusive, the greatest average excess in temperature is noted for the extreme northwest, where it amounts to 33°.3, and the greatest average deficiency is shown for the southeastern slope of the Rocky Mountains, where it is 23°.2. Frost was reported as far south as Lee county, Fla., on the 30th. The first killing frost of the season occurred in Alabama on the 29th and 30th. In Mississippi all vegetation was reported as having been killed by heavy frost on the 29th. In Texas frost occurred as far south as Brownsville on the 17th. On the Pacific coast frost occurred as far south as Los Angeles, Cal., on five dates.

The heaviest rainfall for the month fell in central Arkansas, where 16.25 inches were reported at Heber, Cleburne Co.; and the precipitation exceeded ten inches in northeastern California, east-central Texas, east-central Pennsylvania, northeastern Maryland, northern New Jersey, extreme southeastern New York, and west-central Connecticut. In areas in the interior of Nevada, extreme northwestern Utah, east-central Arizona, and western Nebraska, no precipitation was reported; and at stations in southern California, the Dakotas, western Minnesota, central Mississippi, and central Florida, less than one-half inch was reported. The precipitation exceeded the average amount for November on the middle Pacific coast, and east of the Rocky Mountains, except on the northeastern slope of the Rocky Mountains, in the extreme northwest, and in the Rio Grande Valley; elsewhere the precipitation was below the average for November. The greatest excesses in precipitation were noted in extreme southeastern New York and in central Arkansas, where the precipitation was six and five inches, respectively, above the average, and the greatest deficiencies

occurred on the coast of Oregon, where the precipitation was more than three inches less than the average amount for November. At Cumberland, Md., Newburyport, Mass., Moorestown and South Orange, N. J., and Wellsborough, Pa., the precipitation for the current month was the heaviest reported for November. The more notable features of the precipitation for the period January 1 to November 30, 1889, inclusive, are: the great excess in the middle Atlantic states, where about one-third more than the usual amount of rain fell, and the marked deficiencies in the extreme northwest and middle plateau region, where the precipitation was about two-thirds of the usual amount for that period. The greatest depth of snowfall reported was sixty-one inches at Summit, Cal. Forty-seven inches were reported at Breckenridge, Colo.; twenty-nine inches at Roswell, N. Mex.; twenty-eight inches at Cisco, Cal.; twenty-two inches at Green Bay, Wis.; twenty-two inches at Blue Knob, Pa.; and twenty-one inches at Alpena, Mich. On the immediate Atlantic coast snow fell as far south

as extreme southern New Jersey; in the east Gulf states, to northern Georgia; in the west Gulf states, to central Texas; in the plateau region, to extreme southern New Mexico and southeastern Arizona; and in northeastern California, Oregon, and eastern Washington.

Damaging floods, resulting from heavy rain, occurred in various parts of Pennsylvania, New Jersey, and southern New York from the 17th to 21st, and in New England, New Jersey, and Delaware on the 27th and 28th. Navigation was interrupted or suspended by ice on the Mississippi River above Keokuk, Iowa, and on the middle and upper Missouri River. Well-defined auroral displays were noted in North Dakota on the 1st and 26th; in Minnesota and Michigan on the 17th; and in Vermont and Maine on the 17th and 26th. Brilliant meteors were reported at Elyria, N. Y., on the 2d; at Alpena, Mich., on the 10th; at Little Rock, Ark., on the 14th; at Fort Sully, S. Dak., on the 17th; at Yates Centre, Kans., on the 23d; at Berkeley, Cal., on the 25th; and at Palestine, Tex., 27th.

#### ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for November, 1889, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on chart ii by isobars. The difference between the mean pressure for November obtained from observations taken twice daily at the hours named and that determined from hourly observations, varied at the stations named below, as follows: At Washington, D. C., Philadelphia, Pa., New York, N. Y., Boston, Mass., Saint Louis, Mo., and Chicago, Ill., the mean of the 8 a. m. and 8 p. m. observations was higher by .017, .009, .010, .013, .006, and .007, respectively, than the true mean pressure, while at Denver, Colo., the mean of the observations taken at these hours corresponded with the mean obtained from hourly observations.

The mean pressure for November, 1889, was highest within an area extending from Colorado northwestward to southern Idaho, where the values rose above 30.25, the highest mean reading, 30.33, being noted at Montrose, Colo. Over the Rocky Mountain and plateau regions, and over the eastern portion of the country, south of the Ohio Valley, the mean pressure was generally above 30.10, and in the Gulf and south Atlantic states rose to 30.15. The mean pressure was lowest in the lower Saint Lawrence valley and in north-central Ontario, where the readings were below 30.00. The mean pressure was below 30.05 on the extreme north Pacific coast, in the British Possessions north of western Montana, and north of a line traced from the central New England coast westward over the lower lake region, and thence northwestward over northern Michigan and Lake Superior.

A comparison of the pressure chart for November, 1889, with that of the preceding month shows that a general increase in pressure occurred, except in northern New England, northern New York, the upper and lower lake regions, the Ohio, upper Mississippi, and Red River of the North valleys, and in Canada east of the one-hundredth meridian. The most marked increase in pressure occurred within an area extending from Colorado northwestward to Idaho, where the mean readings were more than .20 higher than for the preceding month, from which region the increase became gradually less marked northward, and towards the Gulf, Atlantic, and Pacific coasts. Over the northern portion of the upper lake region the decrease in pressure was more than .10, whence it became gradually less marked to a line indicating no change in pressure traced from western Nova Scotia westward to central New York, thence southwestward over the Ohio Valley, and thence northwestward to Manitoba. For October, 1889, the area of highest mean pressure occupied the upper Mississippi and Missouri valleys and the upper lake region, with included values above 30.15, and a well-defined area of low pressure embraced a part

of the southern plateau region. For the current month the area of highest pressure appeared over parts of the middle plateau region and the middle-eastern slope of the Rocky Mountains, with mean readings about .10 higher than the highest means noted for the preceding month, and no area of low pressure appeared within the region of observation.

The mean pressure for November, 1889, was generally above the normal from the Mississippi River and the upper lake region to the Pacific coast, in New England, and along the immediate Atlantic coast. The mean pressure was below the normal in the Saint Lawrence Valley, and thence southwestward to the east Gulf coast. The departures above the normal pressure were greatest over the middle eastern slope of the Rocky Mountains, where, at stations, they amounted to .08; the departures below the normal pressure did not exceed .03.

#### BAROMETRIC RANGES.

The monthly barometric ranges at the several Signal Service stations are shown in the table of miscellaneous meteorological data. The general rule, to which the monthly barometric ranges over the United States are found to conform, is that they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In November, 1889, the monthly ranges were greatest on the southeast coast of New England, where they exceeded 1.30, whence they decreased southward to less than .40 over southern Florida, and westward to less than .90 over Montana, from which latter-named region they increased to more than 1.20 on the extreme north Pacific coast. On the Pacific coast the ranges decreased southward to less than .40 on the coast of southern California. Along the Atlantic coast the extreme monthly ranges varied from .33 at Key West, Fla., to 1.34 at Boston, Mass.; between the eighty-second and ninety-second meridians, .64 at Cedar Keys, Fla., to 1.26 at Port Huron, Mich.; between the Mississippi River and the Rocky Mountains, .73 at Brownsville and San Antonio, Tex., to 1.13 at Saint Vincent, Minn.; in the Rocky Mountain and plateau regions, .42 at Yuma, Ariz., to .94 at Walla Walla, Wash.; on the Pacific coast, .36 at San Diego, Cal., to 1.20 at Port Angeles, Wash.

#### AREAS OF HIGH PRESSURE.

Seven well-defined areas of high pressure were observed within the limits of the United States during the month of November. They were generally first observed in the region north of Montana and Dakota, although two first appeared west of the Rocky Mountain regions. The general direction of movement was to the southward while passing over the eastern slope of the Rocky Mountains, and to the eastward during the transit over the eastern portion of the United States, the direction of movement becoming slightly to the

north of east as the areas approached the Atlantic coast. The average rate of movement was twenty-six miles per hour, and the deviation from this average was relatively slight, the maximum rate of movement being thirty-five miles per hour, while the minimum was only twenty-one.

The following tables exhibit some of the more prominent characteristics of the high areas:

TABLE I.

No.	First observed.		Last observed.		Duration.	Velocity per hr.	Highest pressure.			Reading.
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.		Date.	Station.		
I.....	2	50° 129°	35° 77°	5° 26°	5	Days. Miles.	Inches.			
II.....	6	41° 119°	45° 127°	4° 23°	9	30.74	30.74			
III.....	10	52° 109°	28° 99°	2° 35°	11	30.44	30.52			
IV.....	13	53° 117°	47° 59°	6.5° 21°	16	30.70	30.70			
V.....	21	33° 101°	32° 79°	3° 21°	24	30.38	30.38			
VI.....	23	54° 110°	49° 62°	5° 26°	26	30.68	30.68			
VII.....	26	55° 100°	35° 81°	4° 30°	27	30.96	30.96			
Mean.....	48	113°	39° 83°	4° 3°	26°	30.63	30.63			

\* Moved from central Rocky Mountain regions to the north Pacific coast.

TABLE II.

Number.	Maximum abnormal rise in pressure in twelve hours.			Maximum abnormal fall in temperature in twelve hours.			Maximum wind velocity.			Date.
	Amount.	Station.	Date.	Amount.	Station.	Date.	Miles per hour.	Direction.	Date.	
I.....	Inch.			°						
I.....	.56	Calgary, N. W. T....	2	26°	Swift-Current, N. W. T....	2	48	ne. e.	5	
II.....	.16	Montrose, Colo.....	8	22	Roseburgh, Oregon.....	7	36	n. s.	8.9	
III.....	.50	Denver, Colo.....	11	35	Shreveport, La.....	12	48	n.	11	
IV.....	.50	Fort Custer, Mont....	13	20	Qu'Appelle, N. W. T....	14	40	n. w.	15	
V.....	.30	Nashville, Tenn....	22	21	Rio Grande City, Tex....	21	40	w.	23	
VI.....	.46	Des Moines, Iowa....	24	22	Des Moines, Iowa....	24	43	n. w.	26	
VII.....	.40	Qu'Appelle, N. W. T....	26	21	Des Moines, Iowa....	27	44	w.	30	

The following is a brief description of the weather conditions attending the movements of each area of high pressure observed during the month:

I.—At 8 a. m. of November 2d a storm of considerable energy covered the Lake region, the barometer being unusually low over Lake Superior, while the pressure increased from the centre in all directions within the limits of the United States, indicating the presence of areas of high pressure to the east of Nova Scotia and on the north Pacific coast. The high area to the westward extended over the plateau and Rocky Mountain regions during the 3d and 4th, attended by heavy snows in Colorado and New Mexico. In New Mexico, southern Colorado, and northern Texas, the unusually low temperature and drifting snow caused loss of life and property, especially in the cattle districts. An interesting report relative to this storm has been prepared by M. A. Upson, voluntary observer at Roswell, N. Mex., which will be found under the head of "Snow," in this REVIEW. After the centre reached the upper Missouri valley the area apparently moved directly southward, reaching southern Colorado on the afternoon of the 5th, causing unusually cold weather for the season, the temperature being below 20° over the greater portion of Colorado, while it was above 50° north of Montana, and freezing in northern Texas, where heavy snow was reported on the morning of the 6th. In eastern Colorado this area moved eastward, covering the central valleys during the 6th, and the middle and south Atlantic coasts during the 7th. The northerly winds which resulted from this easterly movement over the Southern States were accompanied by heavy rains in Texas and the lower Mississippi valley, except at New Orleans, where only light showers occurred. This area disappeared to the east of North Carolina during the 7th, reports from the coast indicating that it probably changed its course to the northeast after passing to the Atlantic.

II.—Was probably central to the northwest of Nevada on the 6th. The conditions which favored its formation having extended eastward from the Pacific during the previous day. There was apparently a northeasterly movement during the succeeding twenty-four hours, which carried the centre over Idaho, after which there was a well-marked southeasterly movement during the 7th and 8th, which carried the centre to the southeastern portion of Utah, after which a retrograde movement was observed, which continued during the 9th and 10th, when the centre was on the north Pacific coast west of Oregon where this area was last observed on the morning of the 11th, and it probably joined or formed a part of that described as number iii, which approached from the region north of Montana on the 10th.

III.—On the afternoon of the 10th the barometric pressure was high on the north Pacific coast, and the isobar of 30.20 indicated either the advance of a separate area of high pressure or a re-enforcement from the northward of the area which then extended over the north Pacific coast. While the barometric pressure within the limits of this area was not unusually high, it was attended by high northerly winds, low temperatures, and heavy snows at Rocky Mountain stations during its course southward. It decreased in energy after passing southward of Colorado, but it was felt over New Mexico and the Rio Grande Valley during the 12th, and it was last observed in southern Texas on the 13th. The movement of this area over the Missouri Valley, Kansas, Nebraska, and western Iowa, and thence northward, was accompanied by a well-marked cold wave extending westward to the Rocky Mountains, the change in temperature in twenty-four hours ranging from 20° to 30° on the 11th. This volume of cold air extended southward over Texas and Louisiana, where the change in twenty-four hours on the 12th and 13th ranged from 20° to 30°, and the abnormal change in twelve hours at Shreveport was 35° on the 12th.

IV.—First appeared north of Idaho on the 13th and moved southeastward, following the general course of the Missouri Valley, until the morning of the 14th, when it was central in northern Kansas, and covered the eastern slope of the Rocky Mountains, the barometric pressure being near 30.40 from northern Texas to Manitoba. This condition extended eastward over the central valleys during the 15th and 16th, the pressure increasing during the easterly movement, and the area becoming more extended in the east and west direction along the fortieth parallel from the Atlantic coast to Colorado. During the easterly movement from Kansas to the middle Atlantic states, the pressure at the centre increased three-tenths of an inch, but after reaching the middle Atlantic coast the direction of movement became northeasterly, and the pressure declined rapidly on account of the advance of a storm from the southwestward. By the 20th this area had passed to the eastward beyond the limits of the stations of observation.

V.—This was an area of high pressure of slight intensity which apparently developed in northern Texas on the 21st. It passed southeastward to the Gulf, and thence eastward to Florida, attended by generally clear weather and no marked atmospheric disturbance. The pressure increased and the area extended during the easterly movement. Light frosts occurred in the south Atlantic states on the morning of the 24th, when the centre was near the coast line. It apparently disappeared to the east of the Atlantic coast line during the 24th, after which it probably formed a part of the high area traced as number vi.

VI.—On the morning of the 23d this area was observed far to the north of Montana. It moved southeastward with increasing energy and pressure, extending over the Northwest on the 24th and the central valleys on the 25th. It was attended by a slight cold wave over limited portions of Missouri and the Ohio Valley, but the fall in temperature was not unusual. The direction of movement changed when the centre reached the upper Mississippi valley, and the area moved directly eastward over the Lake region to the Atlantic coast,

after which it followed a northeasterly course, passing over New England on the 27th, and over the Maritime Provinces on the 28th. It was generally attended by fair weather until the advance of the storm from the southwest caused snow and rain in its west quadrants. It disappeared quickly after reaching New England, the velocity apparently increasing after the centre of greatest pressure reached the coast.

VII.—Appeared to the north of eastern Montana on the 26th, and followed the same general course to the south and eastward as described for the preceding area, only that the centre moved farther to the south, reaching Indian Territory before the easterly movement commenced. It was the most marked area of high pressure which occurred during the month, and the maximum pressure, 30.96, with a temperature of  $-16^{\circ}$ , occurred at Qu'Appelle, N. W. T., on the 27th. This area was preceded by the most severe storm of the month in the Lake region, and was attended by a cold wave generally throughout the Northwest. It extended southward to the Gulf coast, and westward over the Rocky Mountain regions, but the pressure decreased at the centre, and it lost intensity after extending over the central valleys and the Atlantic coast. At the close of the month it covered the eastern portion of the United States, and was central in the upper Ohio valley.

#### AREAS OF LOW PRESSURE.

Eight areas of low pressure were observed within or near the limits of the United States during the month of November, although in three cases the area of disturbance divided, forming secondary disturbances which were readily traced from the regular telegraphic reports. The mean latitude of the tracks of the low areas observed is to the south of the normal track of November storms, and the direction of movement was generally to the northeast after reaching the central valleys. The region of greatest storm frequency extends from Texas northeastward to the lower lake region. Seven areas of low pressure passed over the Atlantic coast within the limits of the United States, while only two were observed in the upper Missouri valley and in the northern Rocky Mountain region, and the direction of movement of the two areas of low pressure observed in the extreme northwest was to the south of east while central to the west of the Mississippi Valley. The average rate of movement was about thirty miles per hour, while the maximum rate was fifty-two miles and the minimum fourteen.

I.—This disturbance had developed at the close of the previous month, and has been traced as number xii on chart i of the October WEATHER REVIEW. At 8 p. m. of October 31st it extended over the southwest, being central in the eastern portion of Indian Territory, from which region it moved almost directly north during the 1st and 2d of November, increasing greatly in intensity during the northerly movement, the pressure at the centre decreasing about six-tenths of an inch during its passage from Indian Territory to Lake Superior. It was attended by general rains throughout the country east of the Rocky Mountain slope, dangerous gales on the Lakes, and high winds on the New England coast. After reaching Lake Superior it apparently moved to the northeast, and although the centre of disturbance was far to the north of the Saint Lawrence Valley, its northeasterly movement was indicated by the reports from the Maritime Provinces, where strong southwesterly gales occurred on the 3d. After passing to the northeast of Lake Superior a sharp fall of temperature occurred in the upper lake region, attended by heavy snow in portions of the upper lake region and upper Mississippi valley.

II.—The telegraphic report of the 5th indicated the presence of this disturbance far to the north of Montana, while an area of high pressure covered the greater portion of the United States, extending from the Atlantic to the Pacific coasts, the centre of greatest pressure being immediately south of the area of low pressure. This storm moved directly eastward north of the United States, attended by a corresponding easterly movement of the area of high pressure to the southward. It apparently increased in energy during the

easterly movement. Although it did not produce any marked change in the weather conditions within the limits of the United States, the winds attained a maximum velocity exceeding forty miles per hour in the lower lake region and in the Saint Lawrence Valley during its passage to the north of those sections.

III.—This disturbance apparently developed near the west Gulf coast, where it was central on the morning of the 7th, although the heavy rains and northerly winds in that section indicate that it may have existed over the Gulf south of Galveston previous to that date. It passed northward from Louisiana to Illinois during the twenty-four hours following its first appearance, causing general rains throughout the central valleys and thence eastward to the Atlantic coast. During the northern movement the barometric gradient became less, and during the 8th two disturbances of slight energy formed, one south of the upper Ohio valley, and one in northern Indiana. The latter disappeared during the 9th, while the former passed eastward off the middle Atlantic coast, causing moderate gales in southeast New England on the 10th. It increased in violence after leaving the coast, and passed over the north Atlantic from the 11th to the 14th, causing severe gales.

IV.—This disturbance developed over Montana during the night of the 9th, but it was preceded by an area of low pressure which was central north of Montana on the 8th and moved eastward north of the United States to the region of Lake Superior, where it disappeared apparently by increase of pressure due to the advance of an area of high pressure from the northwestward. This area of high pressure also forced the storm which was central over Montana rapidly to the southeastward, and on the afternoon of the 10th it covered Colorado and on the morning of the 11th it had passed as far south as northern Texas, attended by heavy snow, strong northerly gales, and a cold wave at central Rocky Mountain stations. The principal disturbance continued its southerly course until the centre reached southeastern Texas, but a secondary disturbance formed in the lower Missouri valley and moved northeastward to the upper lake region, where it was central on the afternoon of the 12th. The storm in Texas changed direction to the northeast and moved over the lower Mississippi valley during the 12th, attended by heavy rains. By the morning of the 13th the storm in the Lake region had united with the principal disturbance, which was then central in eastern Kentucky. During the 13th it moved eastward to the middle Atlantic coast, the pressure decreasing rapidly during the easterly movement. After the centre of disturbance passed east of the coast line the storm increased greatly in energy, and dangerous gales were reported along the Nova Scotia and Newfoundland coasts during the 14th and 15th.

V.—This storm apparently developed in the Gulf, south of New Orleans, during the 16th. Its centre reached the coast near Pensacola on the afternoon of the 16th, after which the storm divided, forming two disturbances, one of which passed northeastward, following the coast line from Georgia to Maine, and the other passed northward to the Ohio Valley and the lower lake region. Heavy rains generally occurred in the southern states east of the Mississippi during the passage of this storm over that region. High winds occurred on the south Atlantic and Gulf coasts, and the clearing weather which followed was attended by light frosts in southern Texas and along the Gulf coast as far east as Pensacola. The pressure at the centre of these disturbances decreased during the northerly movements until the storms reached the lower lake region and the middle Atlantic coast. While the area traced as number v was more clearly defined, the strong easterly gales which occurred in southeast New England on the 19th indicated that the disturbance traced as number v a passed off the middle Atlantic coast and thence northward along the New England coast during the night of the 19th. The maximum velocity at Block Island, R. I., during the 19th was sixty miles from the east, and on the same day the maximum velocity at

New York, N. Y., was thirty-two miles from the north. Brisk and high northeasterly winds continued on the northern New England coast during the 20th, but the storm apparently disappeared after reaching northern New England. The western branch of this disturbance, after reaching the lower lake region, apparently passed to the north of Lake Huron, and it was quickly followed by a storm from the southwest traced as number vi.

VI.—This disturbance was first observed in northern Texas in the southeast portion of a barometric trough which extended over the Rocky Mountain regions and the north Pacific coast. During the preceding day a general storm had prevailed over the Pacific coast and the north-central plateau regions, attended by heavy rains as far south as southern California, the centre of disturbance being on the north Pacific coast where the barometer was unusually low, that at Fort Canby, Wash., being 29.38 on the morning of the 19th. The pressure increased rapidly on the north Pacific coast during the night of the 19th, and the barometric trough moved eastward to the central valleys during the 20th, the disturbance over northern Texas becoming more clearly defined as it approached the lower Mississippi valley. On the morning of the 21st it was central near Cairo, Ill., and the rain area extended over the central valleys and the Lake region. A secondary disturbance formed near the south Atlantic coast on the 21st, and while the principal disturbance moved to the lower lake region and the Saint Lawrence Valley, the secondary disturbance passed along the Atlantic coast, causing strong easterly gales in southern New England on the 21st. These disturbances apparently united in the northern portion of New England on the 22d, after which this storm apparently moved northeastward beyond the stations of observation.

VII.—This is the only disturbance of the month traced to the eastward of the Rocky Mountains from the Pacific coast. On the morning of the 22d it was central over Oregon, attended by heavy rains on the coast and snow in the interior. On the afternoon of the 22d it covered the northern Rocky Mountain regions. During the 23d it passed over the Dakotas and Iowa, but the weather continued fair in the Northwest. The pressure increased at the centre of this disturbance after passing to the east of the Rocky Mountains, and it disappeared to the northeast of the upper lake region during the 24th, without causing any decided change in the weather conditions within the limits of the United States.

VIII.—Apparently developed in southern Texas on the 26th. It passed rapidly to the northeastward, causing general rains, except in the Northwest and the upper lake region, where snows were reported on the 26th, 27th, and 28th. The storm increased in violence during the northeasterly movement, and the strong gales, attended by freezing weather and snow, in the

Lake region, caused much damage to shipping, although the warning signals had been displayed in advance of this storm at the lake ports. After the centre of disturbance reached the southern portion of the upper lake region, a secondary disturbance formed over the middle Atlantic states, which, however, quickly united with the principal disturbance in northern New England on the 28th. Heavy rains and severe easterly gales occurred along the New England coast as the centre of disturbance passed northeastward to the Saint Lawrence Valley, and brisk to high winds and snow continued in the lower lake region during the 29th after the centre of disturbance had passed to the northeast of the Maritime Provinces.

The following tables exhibit some of the principal facts regarding these low areas:

TABLE I.

No.	First observed.			Last observed.			Duration.	Velocity per hr.	Lowest pressure.	
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.	Date.			Station.	Reading.
I.....	1	35° 32' 32"	92° 49'	35° 57'	28.0	2	Port Arthur, Ont.....	29.32		
II.....	2	35° 32' 32"	100° 50'	32° 57'	2.0	2.0	Father Point, Quebec.....	29.32		
III.....	3	31° 31'	93° 42'	35° 1.5	28.0	7	Memphis, Tenn.....	29.32		
IIIa.....	8	37° 37'	82° 40'	70° 1.5	18.0	10	Nantucket, Mass.....	29.32		
IV.....	10	40° 112'	44° 68'	68° 4.0	40.0	15	Saint John's, N. F.....	29.13		
V.....	16	29° 89'	46° 79'	45° 14.0	14.0	20	Parry Sound, Ont.....	29.56		
Va.....	17	32° 82'	46° 67'	45° 14.0	4.5	19	Atlantic City, N. J.....	29.72		
VI.....	19	35° 100'	51° 62'	40° 31.0	2.0	22	Portland, Me.....	29.72		
VIIa.....	21	37° 72'	47° 66'	31.0	2.0	22	Chatham, N. B.....	29.24		
VII.....	22	43° 117'	45° 83'	31.0	2.0	22	Chatham, N. B.....	29.24		
VIII.....	26	27° 99'	52° 64'	34.0	3.5	28	Fort McKinney, Wyo.....	29.48		
Mean.....	37	95	47	71	2.7	30.5	.....	29.40		

TABLE II.

Number.	Maximum abnormal fall in pressure in twelve hours.			Maximum abnormal rise in temperature in twelve hours.			Maximum wind velocity.		
	Amount.	Station.	Date.	Amount.	Station.	Date.	Miles per hour.	Direction.	Date.
I.....	.52	Winnipeg, Man.....	2 21	9	Sydney, C. B. I.....	3 3	45	*	2, 3
II.....	.46	Medicine Hat, N. W. T.....	5 26	26	Swift Current, N. W. T.....	4 4	44	W.	7, 8
III.....	.30	Memphis, Tenn.....	7 24	24	Bismarck, N. Dak.....	8 36	36	T	10
IIIa.....	.22	Halifax, N. S.....	9 17	17	Chattanooga, Tenn.....	8 45	45	NE.	10
IV.....	.60	Halifax, N. S.....	14 18	18	Montgomery, Ala.....	12 45	45	NW.	10
V.....	.30	Louisville, Ky.....	17 13	13	Knoxville, Tenn.....	17 36	36	E.	17
Va.....	.34	Norfolk, Va.....	17 15	15	Wilmington, N. C.....	17 60	60	E.	19
VI.....	.34	Abilene, Tex.....	19 20	20	Abilene, Tex.....	19 56	56	N.	20
VIIa.....	.40	Atlantic City, N. J.....	21 19	19	Charleston, S. C.....	21 48	48	SE.	21
VII.....	.58	Fort McKinney, Wyo.....	22 31	31	Pueblo, Colo.....	23 45	45	W.	23
VIII.....	.64	Albany, N. Y.....	28 26	26	Bismarck, N. Dak.....	25 72	72	NE.	28

\*SW., W., and NW.

† N. and NW.

## NORTH ATLANTIC STORMS FOR NOVEMBER, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during November, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Eight depressions have been traced for November, 1889, the average number traced for the corresponding month of the last seven years being 10.7. The greatest number of depressions traced was fourteen, in 1887, and the least number was seven, in 1882. Of the depressions traced for the current month, five advanced eastward from the American coast between the thirty-fifth and fiftieth parallels; one apparently moved eastward from the Labrador coast; one first appeared southeast of the Banks of Newfoundland, and one is given a track from mid-ocean in high latitudes to the north of the

British Isles. The depressions generally pursued east to northeast tracks, and in each instance the centre of disturbance passed north of the region of observation before reaching the European coast. The month opened with very low pressure over the British Isles, a barometer reading of 28.82 (732) being reported at Leith, Scotland, on the 1st. From this date until the 5th, and from the 24th to 27th, the pressure was generally low over the British Isles; during the remainder of the month high pressure prevailed in that region. Over mid-ocean on the 1st, 2d, 4th, and 5th fresh to strong gales prevailed along the trans-Atlantic tracks, attending the presence to the northward of areas of low pressure. On the 7th and 8th a depression moved northward east of the Grand Banks, and another depression passed eastward over northern Newfoundland, causing fresh to strong gales between the thirtieth and sixtieth meridians. On the 11th, 12th, and 13th, gales of hurricane force were encountered over and near the Banks of

Newfoundland, attending the passage of a depression which moved eastward from the middle Atlantic coast during the 10th, and on the 14th gales of hurricane force attended the passage of this depression over mid-ocean. On the 14th and 15th severe gales, attaining hurricane force, attended the passage of a depression south of Nova Scotia and Newfoundland and over the Grand Banks. Fresh to strong gales continued over mid-ocean from the 18th to 22d, during which period a depression was central north of the region of observation. From the 27th to 29th strong to whole gales were caused over mid-ocean by a depression which had advanced from the Gulf of Saint Lawrence, and which, on the 30th, was central west of the British Isles. From the 17th to 19th, and on the 27th and 28th, severe gales were reported off the south Atlantic coast, attending the passage of low areas v and viii.

The following is a brief description of the movements of areas of high pressure over the north Atlantic during the month: An area of high pressure which occupied the ocean between Nova Scotia and the West Indies on the 1st, extended over Newfoundland and the Grand Banks by the 2d, and thence moved southeast over the Azores by the 5th, whence it extended northeast over the British Isles by the 5th. From the 7th to 10th the pressure continued high from the British Isles to the Azores. On the 4th an area of high pressure appeared off the middle and south Atlantic coasts, and gradually extended eastward until the 8th, when it united with the area of high pressure which extended from the Azores to the British Isles, the western limit of which contracted east and northeast until the 11th, when the area covered only the British Isles and the adjacent ocean east of the twentieth meridian. On the 12th an area of high pressure moved off the New England and middle Atlantic coasts, and on the 13th occupied an elongated area extending southward from Newfoundland, after which it disappeared by a decrease of pressure. On the 15th an area of high pressure moved off the United States coast, and by the 17th presented an elongated area extending from the coast between Nova Scotia and the Carolinas southeastward to the fiftieth meridian. By the 18th this area had contracted to the northward, and on the 19th formed a small area southeast of Nova Scotia. This area moved eastward to the British Isles by the 23d, after which it probably passed over the continent of Europe. On the 23d an area of high pressure moved off the Florida and south Atlantic coasts and gradually extended east and northeast until the 28th, when the pressure was high from Newfoundland to the Azores. This area contracted to the southeastward during the 29th and 30th. On the 29th an area of high pressure appeared off the Florida and south Atlantic coasts and extended east and northeast during that and the following date.

During the last seventeen years but three storms of pronounced strength have been traced northward from the West Indies in November. In 1879 a West Indian hurricane, first located over the southeastern Bahamas, moved rapidly northward and northeastward, passing Cape Hatteras the night of the 19th, and Halifax, N. S., the afternoon of the 20th, and thence moved northeast over the Gulf of Saint Lawrence or Newfoundland. Furious gales, attaining hurricane force at sea, attended the passage of this storm, and barometer readings falling to, or nearly to, 29.00 (737) were reported by shipmasters. In 1887, on the 29th and 30th, the path of a depression was approximately located north of the West Indies, and from the 28th to 30th heavy gales, attaining hurricane force, were reported in that region. In 1888 a storm was first located northeast of the Windward Islands under date of the 17th, whence it moved westward to the Bahama Islands by the 22d, where it recurved to the northward, and moved north-northeast to eastern New England by the 28th. This storm was attended by very destructive gales off the coast of the United States from the 21st to 27th. After its recurve over the Bahamas it augmented in energy until the 26th, when minimum pressure falling below 29.00 (737) was reported, after which there was a marked diminution in energy.

Among the more notable November American storms whose influence has been severely felt off the coast are: a storm in 1873, which developed over northern Georgia on the 16th, passed off the North Carolina coast on the 17th, and over the Bay of Fundy into the Gulf of Saint Lawrence during the 18th, attended by fierce gales and fearful seas. At Norfolk, Va., the barometer fell to 28.86 (733) on the 17th. In Chesapeake Bay the storm was extremely severe. At Cape May, N. J., the barometer fell to 28.76 (730), and the gales off the coast were reported the severest in years. On the 18th at New Haven, Conn., the barometer fell to 28.72 (729); at Wood's Holl, Mass., to 28.60 (726); at Boston, Mass., to 28.61 (727), and at Portland, Me., to 28.49 (724). At Eastport, Me., the wind reached a velocity of sixty-four miles per hour at about 6 p. m. of the 18th. The storms over the Canadian Provinces were equally severe. The whole course of the storm was attended by heavy rain or snow. In 1877, during the night of the 23d-24th, when a storm which had advanced from the north Pacific coast to the south Atlantic coast was central in West Virginia, the U. S. S. "Huron" was wrecked on the North Carolina coast fifty miles north of Cape Hatteras. A southeasterly wind was blowing, with a heavy southeast swell, at the scene of the disaster.

Compared with the corresponding month of the last seven years the storms over the north Atlantic Ocean during November, 1889, were deficient in number and energy.

The following are brief descriptions of the depressions traced:

1.—This depression advanced eastward over the ocean north of the fifty-fifth parallel during the 1st and 2d, attended along the trans-Atlantic routes by moderate to fresh gales, and on the 3d was apparently central north of the British Isles, after which it disappeared to the eastward.

2.—This depression passed eastward from the Labrador coast during the 4th, and thence moved north of east to about the forty-second meridian by the 5th, after which it advanced northeastward beyond the region of observation.

3.—This depression apparently developed southeast of the Banks of Newfoundland, where it was central on the 7th, whence it moved north-northeast north of the fiftieth parallel by the 8th, with fresh gales, and passed thence northeastward beyond the region of observation.

4.—This depression was a continuation of low area ii and moved east from the Gulf of Saint Lawrence to the north of the Banks of Newfoundland by the 8th, after which it passed northeastward beyond the region of observation.

5.—This depression was a continuation of low area iii which advanced eastward from the middle Atlantic coast to about the seventy-first meridian by the morning of the 10th. Moving eastward the centre of depression passed along or near the southern edge of the Banks of Newfoundland during the 11th and thence east-northeast to the forty-fourth meridian by the 12th, after which it moved northeastward and disappeared in the direction of Iceland after the 14th. This depression was attended by probably the severest storms of the month. During the 11th, 12th, and 13th, gales of hurricane force were encountered over and near the Banks of Newfoundland, and on the 14th, when the depression was central over mid-ocean, the pressure had fallen to about 29.20 (742), and gales of hurricane force were reported.

6.—This depression was a continuation of low area iv and on the morning of the 14th was central south of Nova Scotia, whence it moved northeast to the fortieth meridian by the 16th, after which it apparently recurved westward and united with depression number 7, which had advanced northeast from southern Newfoundland. This depression was also attended by gales of hurricane force, and on the 14th and 15th barometric pressure falling below 29.00 (737) was reported.

7.—This depression first appeared over southern Newfoundland on the morning of the 16th, and was probably a subsidiary development to number 6. By the 17th the centre of disturbance had moved to the north of the Grand Banks, after which it disappeared beyond the region of observation.

**8.**—This depression was central off the south coast of Newfoundland on the 26th, whence it moved northeastward to the thirty-first meridian by the 28th, and during the 29th and 30th passed slowly eastward in about latitude N.  $55^{\circ}$  to the twentieth meridian. This depression was attended by storms of considerable strength, and on the 27th gales attaining hurricane force were reported over mid-ocean.

#### FOG IN NOVEMBER.

The following are limits of fog-areas on the north Atlantic Ocean, west of the fortieth meridian, for November, 1889, as reported by shipmasters :

Date.	Entered.		Cleared.		Date.	Entered.		Cleared.	
	Lat. N.	Lon. W.	Lat. N.	Lon. W.		Lat. N.	Lon. W.	Lat. N.	Lon. W.
2	37 05	75 29	37 09	75 19	22	46 33	53 35	45 53	54 45
5	46 42	47 24	46 50	46 50	22-23	47 10	44 30	45 02	51 53
12	38 40	74 58	38 28	74 49	23	45 03	55 48	44 54	56 09
13	37 26	75 09	37 12	75 36	25	48 32	48 30	48 12	49 11
13-14	41 06	69 04	40 48	70 34	26-27	46 40	47 39	45 55	49 31
20	41 08	66 10	41 05	66 20	29	46 05	55 45	45 39	59 15
22	45 12	48 11	44 10	52 17	30	46 00	47 00	45 30	48 30

The limits of fog-belts, west of the fortieth meridian, are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on seven dates; between the fifty-fifth and sixty-fifth meridians on two dates; and west of the sixty-fifth meridian on five dates. Compared with the corresponding month of the last two years the dates of occurrence of fog near Newfoundland in November, 1889, were two in excess of the average; between the fifty-fifth and sixty-fifth meridians three less than the average; and west of the sixty-fifth meridian five less than the average. Over and near the Banks of Newfoundland dense fog was reported on the 5th, 22d, 23d, 25th to 27th, and 30th, with the approach or passage to the northward of areas of low pressure.

Between the fifty-fifth and sixty-fifth meridians fog was reported on the 23d and 29th, with the presence to the northward of areas of low pressure. West of the sixty-fifth meridian fog was reported on the 2d, with south to east winds and high pressure; from the 12th to 14th, with rapidly falling barometer and easterly winds, attending the advance from the southwestward of an area of low pressure; and on the 20th, with south to east winds, attending a depression to the westward.

#### OCEAN ICE IN NOVEMBER.

On chart i the positions of icebergs reported for the month are shown by ruled shading:

Ocean ice has been reported for November, 1889, as follows:

1st.—N.  $46^{\circ} 47'$ , W.  $48^{\circ} 00'$ , two small bergs and thirteen smaller pieces in the immediate vicinity; N.  $52^{\circ} 30'$ , W.  $53^{\circ} 16'$ , a large berg; N.  $52^{\circ} 58'$ , W.  $51^{\circ} 14'$ , a large berg.

3d.—N.  $52^{\circ} 01'$ , W.  $54^{\circ} 25'$  to N.  $52^{\circ} 37'$ , W.  $51^{\circ} 58'$ , four bergs.

4th.—N.  $46^{\circ} 47'$ , W.  $48^{\circ} 27'$ , a small berg.

5th.—N.  $52^{\circ} 06'$ , W.  $54^{\circ} 08'$  to the Straits of Belle Isle, several large bergs.

7th.—N.  $51^{\circ} 36'$ , W.  $54^{\circ} 55'$ , a large berg; in the Straits of Belle Isle, four bergs, apparently aground.

16th.—N.  $44^{\circ} 56'$ , W.  $49^{\circ} 00'$ , a berg three hundred feet high and eight hundred feet long.

In November, 1888, 1887, 1883, and 1882, no Arctic ice was reported near Newfoundland or the Grand Banks. In 1886 only one berg, fifty to sixty feet high, was reported, observed on the 2d in N.  $45^{\circ} 20'$ , W.  $45^{\circ} 26'$ . In 1885 the only iceberg reported was observed in N.  $48^{\circ} 00'$ , W.  $51^{\circ} 10'$ . In 1884 several icebergs were seen in N.  $45^{\circ} 56'$ , W.  $52^{\circ} 38'$ . From the above it will be seen that during the last eight years there have been four years in which no ice was reported for November, and that for the current month the aggregate quantity reported greatly exceeded the average amount noted for the corresponding month of the last eight years.

#### TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for November, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

For November, 1889, the mean temperature was highest over southern Florida, where the highest mean reading,  $76^{\circ} 0$ , was noted at Key West. The mean temperature was above  $60^{\circ}$  on the Atlantic coast south of the thirty-second parallel, in Florida, except at extreme northwestern stations, along the west Gulf coast and in the lower Rio Grande Valley, in extreme southwestern Arizona, and in California south of the thirty-fifth parallel, and the mean temperature was generally above  $50^{\circ}$  south of a line traced from the middle Virginia coast irregularly west-southwest to extreme western Texas, and west of a line traced from southeastern Arizona northwestward to and along the immediate north Pacific coast to the mouth of the Columbia River. The mean temperature was lowest in the British Possessions north of Minnesota and North Dakota, the lowest mean reading,  $20^{\circ}$ , being noted at Minnedosa, Man. The mean readings were below  $25^{\circ}$  in the Valley of the Red River of the North and thence west of south to south-central South Dakota, over northern Minnesota, the northern part of

North Dakota, northeastern Montana, southeastern Wyoming, and central Colorado, and were below  $40^{\circ}$  north of a line traced from the east New England coast irregularly west-southwest to southern New Mexico, thence northwestward to northeastern California, and thence northward to the British Possessions.

In the United States the mean temperature was below the normal from the one-hundred and tenth meridian eastward to a line traced irregularly southeastward from Manitoba to the east Gulf coast. From the Valley of the Red River of the North eastward over the upper lake region and Canada; from the lower lake region southward over Florida; in the plateau regions; on the Pacific coast, and in the Canadian Northwest Territories the month was generally warmer than the average November. The departures below the normal temperature were greatest in central Texas and central Colorado, where they exceeded  $5^{\circ}$ . In districts where the mean temperature was above the normal the departures were less than  $5^{\circ}$ . The only station in the Atlantic coast states which reported mean temperature below the normal was Washington, D. C., where the deficiency was but  $0^{\circ} 8$ . Considered by districts the greatest average departure below the normal temperature,  $4^{\circ} 5$ , occurred on the southeastern slope of the Rocky Mountains; on the middle-eastern slope of the Rocky Mountains the average departure below the normal temperature was  $4^{\circ} 2$ ; in the west Gulf states,  $3^{\circ} 8$ ; in the upper Mississippi and Missouri valleys,  $3^{\circ} 2$ ; in the Rio Grande Valley,  $1^{\circ} 8$ ; on the northeastern slope of the Rocky Mountains,  $0^{\circ} 9$ ; in the east Gulf states and over the southern plateau region,  $0^{\circ} 6$ ; and in the Ohio Valley,  $0^{\circ} 2$ . The greatest average departure above the normal temperature,  $3^{\circ} 6$ , occurred on the south Pacific coast; on the middle Pacific coast the average departure above the normal tempera-

ture was  $2^{\circ}.4$ ; in New England,  $2^{\circ}.3$ ; on the north Pacific coast,  $2^{\circ}.2$ ; in the south Atlantic states,  $2^{\circ}.0$ ; in the middle Atlantic states,  $1^{\circ}.6$ ; in the upper lake region,  $1^{\circ}.5$ ; over the northern plateau region,  $1^{\circ}.4$ ; in Florida and the lower lake region,  $1^{\circ}.2$ ; and in the extreme northwest,  $0^{\circ}.4$ . In the middle plateau region the mean temperature averaged normal.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.	Below normal.
Chatham, N. B.....	5.0
San Diego, Cal.....	4.0
Winnipeg, Man.....	4.0
New Haven, Conn.....	3.2
Portland, Oregon.....	2.6
Abilene, Tex.....	6.2
Fort Elliott, Tex.....	4.8
Denver, Colo.....	5.6
Saint Louis, Mo.....	3.6
Fort Sully, S. Dak.....	3.6

For the period from January 1 to November 30, 1889, there has been an average excess in temperature of  $11^{\circ}$  in New England; of  $7^{\circ}$  in the upper lake region; of  $33^{\circ}$  in the extreme northwest; of  $8^{\circ}$  in the Missouri Valley; of  $18^{\circ}$  on the northeastern slope of the Rocky Mountains; of  $10^{\circ}$  over the southern plateau region; of  $5^{\circ}$  over the middle plateau region; of  $21^{\circ}$  over the northern plateau region; of  $22^{\circ}$  on the north Pacific coast; of  $14^{\circ}$  on the middle Pacific coast, and of  $11^{\circ}$  on the south Pacific coast. On the south Pacific coast the mean temperature has been above the normal, except in May and July; on the north Pacific coast, except in August and September; on the middle Pacific coast, except in January, May, and July; over the northern plateau region, except in January, August, and September; over the middle plateau, except in January, February, and September (normal in November); over the southern plateau region, except in January, February, and November; on the northeastern slope of the Rocky Mountains, except in May, July, September, and November; in the Missouri valley, except in February, May to July, and September to November; in the extreme northwest, except in May to July, and September; in the upper lake region, except in February, May, June, September, and October, and in New England, except in February, July, August, and October (normal in September). For this period there has been an average deficiency in temperature of  $5^{\circ}$  in the middle Atlantic states; of  $12^{\circ}$  in the south Atlantic states; of  $23^{\circ}$  in the Florida Peninsula; of  $18^{\circ}$  in the east Gulf states; of  $16^{\circ}$  in the west Gulf states; of  $14^{\circ}$  in the Rio Grande valley; of  $15^{\circ}$  in the Ohio Valley; of  $6^{\circ}$  in the lower lake region; of  $9^{\circ}$  in the upper Mississippi valley; of  $1^{\circ}$  in the middle-eastern slope of the Rocky Mountains, and of  $23^{\circ}$  on the southeastern slope of the Rocky Mountains. In the middle Atlantic states the mean temperature has been below the normal, except in January, March to May, and November; in the south Atlantic states, except in January, April, May, and November; in the Florida Peninsula, except in November (normal in January); in the east and west Gulf states, except in January and April; in the Rio Grande Valley, except in January (July, August, October, and November normal); in the Ohio Valley, except in January, March, and April; in the lower lake region, except in January, March, April, and November; in the upper Mississippi valley, except in January, March, and April; on the middle-eastern slope of the Rocky Mountains, except in January, March, April, and August (normal in October), and on the southeastern slope of the Rocky Mountains, except in January, April, and October.

#### DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for November for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for November, 1889; (4) the departure of the current month from the normal; (5) and the extreme monthly means for November, during the period of observation and the years of occurrence:

State and station.	County.	Normal for the month of Nov., 1889.				(5) Extreme monthly mean temperature for Nov.		
		(1) Normal for Nov., 1889.	(2) Length of record.	(3) Mean for Nov., 1889.	(4) Departure from normal.	Highest.	Year.	Lowest.
Arkansas.								
Lead Hill.....	Boone.....	° 47.3	8	44.1	-3.2	50.0	1883	44.1
California.								
Sacramento.....	Sacramento.....	52.7	36	47.6	-5.1	57.5	1873	46.0
Colorado.								
Fort Lyon.....	Bent.....	36.9	20	.....	.....	44.6	1867	19.6
Connecticut.								
Middletown.....	Middlesex.....	39.3	23	42.5	+3.2	45.1	1859	31.6
Florida.								
Merritt's Island.....	Brevard.....	66.1	5	68.3	+2.2	69.1	1884	60.0
Georgia.								
Forsey.....	Monroe.....	56.0	14	57.2	+1.2	59.0	1874	51.0
Illinois.								
Peoria.....	Peoria.....	39.6	33	39.3	-0.3	44.6	1867	30.2
Riley.....	McHenry.....	33.6	33	33.9	+0.3	40.3	1865	24.1
Indiana.								
Vevay.....	Switzerland.....	43.5	24	43.5	0.0	48.7	1879	33.0
Iowa.								
Cresco.....	Howard.....	28.5	17	28.2	-0.3	34.7	1878	19.2
Monticello.....	Jones.....	33.5	34	33.0	-0.5	41.5	1859	24.4
Logan.....	Harrison.....	35.8	15	35.4	-0.4	41.2	1878	27.5
Kansas.								
Lawrence.....	Douglas.....	40.0	21	38.2	-1.8	45.8	1878	31.6
Wellington.....	Sumner.....	41.3	10	.....	.....	45.5	1879	29.0
Louisiana.								
Grand Coteau.....	Saint Landry.....	59.9	7	56.2	-3.7	64.0	1883	56.2
Maine.								
Orono.....	Penobscot.....	33.6	19	38.6	+5.0	38.6	1880	27.1
Maryland.								
Cumberland.....	Allegany.....	39.8	30	41.8	+2.0	44.7	1883	32.7
Massachusetts.								
Amherst.....	Hampshire.....	38.2	53	42.2	+4.0	44.1	1849	29.7
Newburyport.....	Essex.....	39.6	11	42.1	+2.5	42.1	1889	36.5
Somerset.....	Bristol.....	40.3	17	45.2	+4.9	45.2	1889	33.0
Michigan.								
Kalamazoo.....	Kalamazoo.....	36.7	13	39.0	+2.3	41.0	1879	27.0
Thornville.....	Lapeer.....	37.8	12	38.9	+1.1	45.4	1877	28.4
Minnesota.								
Minneapolis.....	Hennepin.....	29.0	24	28.2	-0.8	36.3	1870	17.4
Montana.								
Fort Shaw.....	Lewis & Clarke.....	33.2	21	37.3	+4.1	43.3	1867	19.9
New Hampshire.								
Hanover.....	Grafton.....	34.0	52	36.8	+2.8	41.6	1849	24.8
New Jersey.								
Moorestown.....	Burlington.....	41.8	26	44.8	+3.0	45.3	1888	36.2
South Orange.....	Essex.....	41.0	19	44.3	+3.3	44.5	1885	32.6
New York.								
Cooperstown.....	Otsego.....	34.8	35	37.7	+2.9	38.5	1876, '77	26.8
Palermo.....	Oswego.....	35.2	35	39.1	+3.9	41.9	1859	26.8
North Carolina.								
Lenoir.....	Caldwell.....	44.9	17	47.0	+2.1	48.8	1878	39.9
Ohio.								
N'th Lewisburgh.....	Champaign.....	39.3	57	40.6	+1.3	49.0	1849	29.0
Wauseon.....	Fulton.....	35.8	19	38.1	+2.3	40.3	1883	27.9
Oregon.								
Albany.....	Linn.....	43.8	10	45.3	+1.5	47.4	1834	40.7
Eola.....	Polk.....	42.7	19	49.6	+6.9	49.0	1889	37.6
Pennsylvania.								
Duberry.....	Wayne.....	34.6	21	37.8	+3.2	38.3	1883	25.7
Grampian Hills.....	Clearfield.....	35.0	25	38.3	+3.3	39.1	1877	28.3
Wellsborough.....	Tioga.....	38.9	10	38.3	-0.6	41.4	1885	37.2
South Carolina.								
Statesburgh.....	Sumter.....	53.6	8	54.3	+0.7	56.0	1883	51.2
Tennessee.								
Austin.....	Wilson.....	47.6	19	49.6	+2.0	54.5	1879	40.2
Milan.....	Gibson.....	47.3	6	46.0	-1.3	49.1	1883	45.5
Texas.								
New Ulm.....	Austin.....	59.1	17	55.4	-3.7	65.6	1879	49.6
Vermont.								
Strafford.....	Orange.....	33.1	16	37.1	+4.0	37.9	1886	23.4
Virginia.								
Birdsheat.....	Northampton.....	49.6	21	51.6	+2.0	55.6	1881	43.0
Wisconsin.								
Madison.....	Dane.....	33.1	20	33.4	+0.3	45.0	1864	23.4
Washington.								
Fort Townsend .....	Jefferson.....	42.6	14	45.0	+2.4	47.3	1884	39.2

The above table shows that at Newburyport, Mass., eleven years record, the mean temperature for the current month,  $42^{\circ}.1$ , was  $0^{\circ}.6$  higher than the highest mean temperature reported for November, noted in 1883; at Somerset, Mass., seventeen years record, the mean,  $45^{\circ}.2$ , was  $0^{\circ}.4$  higher than the highest previous November mean, noted in 1885; at Orono, Me., nineteen years record, the mean,  $38^{\circ}.6$ , was  $1^{\circ}.5$  higher than the highest previous November mean, noted in 1884; and at Eola, Oregon, nineteen years record, the mean,  $49^{\circ}.6$ , was  $2^{\circ}.9$  above the highest mean for November of preceding years, noted in 1877.

At Lead Hill, Ark., eight years record, the mean for the current month,  $44^{\circ}.1$ , was  $1^{\circ}.1$  lower than the lowest mean previously reported for November, noted in 1886 and 1888; and at Grand Coteau, La., seven years record, the mean for November, 1889,  $56^{\circ}.2$ , was  $1^{\circ}.2$  lower than the lowest mean

recorded for the corresponding month of preceding years, noted in 1884.

#### MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperature reported by a regular station of the Signal Service was 90°, at Micco, Fla. The maximum readings were above 80° from central North Carolina southward over eastern, central, and southern Florida, in the Mississippi Valley to about the thirty-third parallel, on the coast of southern Texas, in the lower Rio Grande valley, at Fort Elliott, Tex., and in southwestern Arizona and southern California. The lowest maximum temperature, 49°, was reported at Sault de Ste. Marie, Mich., and the maximum values were below 60° north of a line traced from the central coast of Maine westward over southern Ontario, thence southwestward to central Illinois, and thence northwestward to northern North Dakota, and within an area including the northern and a part of the middle plateau region, and the extreme north Pacific coast. The reports of United States Army post surgeons and state weather service and voluntary observers show maximum temperatures of 90°, or above, as follows: Casa Grande, Ariz., 94°; Cactus and Fresno, Cal., 90°; Manatee, Fla., 92°; Smithville, Ga., 94°; and Fort Ringgold, Tex., 91°. The following shows, by districts, the highest temperature reported at regular stations of the Signal Service for November of preceding years: New England, Boston, Mass., 75°, in 1876; middle Atlantic states, Washington, D. C., 80°, in 1879, Cape Henry, Va., 81°, in 1883; south Atlantic states, Augusta, Ga., 85°, in 1885; Florida Peninsula, Key West, Fla., 91°, in 1876; east Gulf states, New Orleans, La., 85°, in 1888; west Gulf states, Palestine and San Antonio, Tex., 87°, in 1888 and 1879, respectively; Rio Grande Valley, Rio Grande City, Tex., 92°, in 1883; Ohio Valley and Tennessee, Memphis, Tenn., 82°, in 1879; lower lake region, Sandusky, Ohio, 76°, in 1888; upper lake region, Chicago, Ill., 75°, in 1888; extreme northwest, Fort Yates, N. Dak., 76°, in 1887; upper Mississippi valley, Saint Louis, Mo., 82°, in 1879; Missouri Valley, Topeka, Kans., 82°, in 1887; northern slope of the Rocky Mountains, North Platte, Nebr., 81°, in 1887; middle slope of the Rocky Mountains, Fort Reno, Ind. T., 85°, in 1888; southern slope of the Rocky Mountains, Abilene, Tex., 86°, in 1885; southern plateau, Phoenix, Ariz., 97°, in 1884; middle plateau, Winnemucca, Nev., 71°, in 1887; northern plateau, Ashland, Oregon, 78°, in two or more years; north Pacific coast, Roseburgh, Oregon, 70°, in 1884; middle Pacific coast, Red Bluff, Cal., 80°, in 1887; south Pacific coast, Los Angeles, Cal., 88°, in 1884. At the following named stations of the Signal Service the maximum temperature for the current month was as high, or higher, than previously noted for November: Savannah, Ga., nineteen years record, 83°, 1° above maximum of 1875; Jacksonville, Fla., nineteen years record, 86°, 2° above maximum of 1875 and 1877; Vicksburg, Miss., eighteen years record, 85°, the same as maximum of 1885; Fort Canby, Wash., six years record, 66°, 2° above maximum of 1884; Neah Bay, Wash., five years record, 60°, 1° above maximum of 1885; Astoria, Oregon, five years record, 63°, 1° above maximum of 1885. The highest temperatures for November have been generally noted in New England and the east Gulf states in 1882 or 1888; in the middle Ohio valley, lower lake region, upper lake region, upper Mississippi valley, and middle eastern slope of the Rocky Mountains in 1888; in the extreme northwest, northeastern slope of the Rocky Mountains, and northern plateau region in 1887; in the Missouri Valley in 1887 or 1888; on the southeastern slope of the Rocky Mountains in 1885 or 1888; and on the north Pacific coast in 1884. In districts other than those named the periods of occurrence were irregular.

The lowest temperature reported by a regular station of the Signal Service was -28°, at Fort Buford, N. Dak. The temperature fell below zero over a greater part of Minnesota and the Dakotas, northern Nebraska, and northeastern and north-central Montana. The minimum temperature fell below 10°

from the upper lake region westward, north of the thirty-ninth parallel, to the one hundredth meridian, thence southwestward to south-central New Mexico, and over a greater part of the more eastern portions of the middle and northern plateau regions, except in the valleys of the Snake and Columbia rivers, and the minimum readings fell below 30° along the Atlantic coast to the thirtieth parallel; in the Gulf States, save along the immediate Gulf coast; over the Rocky Mountain and plateau regions, except in southeastern Arizona and the adjoining part of California; in Washington and Oregon, except along the coast, and in eastern California north of the thirty-seventh parallel. The highest minimum temperature, 60°, was reported at Key West, Fla., and the minimum values were above 40° over Florida south of the twenty-seventh parallel; on the California coast south of the fortieth parallel; and in the lower Colorado and lower Gila valleys. The reports of United States Army post surgeons and state weather service and voluntary observers show minimum temperature of zero, or below, as follows, the readings being the lowest noted in the several states and territories where the temperature fell to, or below, zero: Frazer and Breckenridge, Colo., -22° and -16°, respectively; Soda Springs, Idaho, -6°; Woodstock, Ill., -1°; Mauzy, Ind., zero; Wesley, Iowa, -9°; Chase, Mich., -4°; Pokegama Falls, Minn., -25°; Camp Poplar River, Mont., -23°; Fort Niobrara, Nebr., -12°; Berlin Mills, N. H., zero; Fort Buford, N. Dak., -28°; Wolsey, S. Dak., -10°; Weathersfield Centre, Vt., -3°; Greenwood, Wis., -5°; and Camp Pilot Butte, Wyo., -11°. The following shows, by districts, the lowest temperature reported at regular stations of the Signal Service for November of preceding years: New England, Eastport, Me., -13°, in 1875; middle Atlantic states, Albany, N. Y., -10°, in 1875; south Atlantic states, Wilmington, N. C., 20°, in 1872; Florida Peninsula, Cedar Keys, 27°, in 1887; east Gulf states, Atlanta, Ga., 16°, in 1887; west Gulf states, Little Rock, Ark., 10°, in 1880; Rio Grande Valley, Brownsville, Tex., 30°, in 1880; and Rio Grande City, Tex., 30°, in two or more years; Ohio Valley and Tennessee, Indianapolis, Ind., and Columbus, Ohio, -5°, in 1880; lower lake region, Oswego, N. Y., -1, in 1875; upper lake region, Duluth, Minn., -29°, in 1875; extreme northwest, Saint Vincent, Minn., -30°, in 1887; upper Mississippi valley, Saint Paul Minn., -24°, in 1875; Missouri Valley, Valentine, Nebr., -32°, in 1887; northern slope, Fort Assinniboine, Mont., -30°, in 1887; middle slope, Denver, Colo., -18°, in 1877; southern slope, Fort Sill, Ind. T., -4°, in 1880; southern plateau, Santa Fé, N. Mex., -11°, in 1880; middle plateau, Montrose, Colo., -18°, in 1886; northern plateau, Fort Klamath, Oregon, 2°, in 1887; north Pacific coast, Roseburgh, Oregon, 18°, in 1880; middle Pacific coast, Red Bluff, Cal., 26°, in 1880; south Pacific coast, Fresno, Cal., 31°, in 1887. At the following-named stations of the Signal Service the minimum temperature for the current month was as low or lower than previously reported for November: Augusta, Ga., seventeen years record, 24°, the same as minimum of 1873; Lava, N. Mex., five years record, 10°, 2° below minimum of 1886; Fort Thomas, Ariz., ten years record, 15°, 1° below minimum of 1880. The lowest temperatures for November have been generally noted in New England in 1875; in the middle Atlantic states and the lower lake region in 1875 or 1880; in the west Gulf states and the Ohio Valley in 1880 or 1887; in the upper lake region and on the middle Pacific coast in 1880; in the extreme northwest, Missouri Valley, middle slope, northern plateau, and north Pacific coast in 1887; in the southern plateau region in 1880 or 1886. In districts other than those named the periods of occurrence were irregular.

#### LIMITS OF FREEZING WEATHER.

The southern limit of freezing weather for November, 1889, is shown on chart iv by a line traced from the eastern coast of Florida, in latitude about N. 29°, north of west over the western extremity of Florida to about the northern line of Louisiana east of the Mississippi River, and thence south of west to the Rio Grande Valley in the vicinity of Rio Grande

City, Tex. The western limit of freezing weather for the month is shown by a line traced from northwestern Washington southward, just east of the coast line, to western Oregon, where it touches the coast, and thence southeastward over northern and eastern California to southwestern Arizona.

#### RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges in temperature occurred in the western Dakotas and eastern Montana, where they were more than  $70^{\circ}$ , whence they decreased eastward to less than  $40^{\circ}$  on the New England and middle Atlantic coasts, southeastward to less than  $30^{\circ}$  over extreme southern Florida, southward to less than  $40^{\circ}$  on the east coast of Texas and less than  $50^{\circ}$  over the southern plateau region, and westward and southwestward to less than  $30^{\circ}$  on the north and middle Pacific coasts.

The following are some of the extreme monthly ranges:

Greatest.	Least.
Fort Buford, Dak.	89.0
Fort Assiniboine, Mont.	77.0
Valentine, Nebr.	69.0
Fort Elliott, Tex.	64.0
Columbia, Mo.	60.0
Tatoosh Island, Wash.	25.0
Key West, Fla.	26.0
Point Reyes Light, Cal.	27.0
Phoenix, Ariz.	36.0
San Diego, Cal.	37.0

#### FROST.

On the 29th and 30th frost occurred as far south as northern Florida, and on the 30th was reported in central and western Florida to Lee county. The report of the Alabama state weather service states that the first killing frost of the season occurred in that state on the 29th and 30th, and that its occurrence was about ten days later than the average date of first killing frost. The report of the Mississippi weather service states that all vegetation was killed by the heavy frost on the 29th. In the west Gulf states and Texas frost was reported as far south as Brownsville, Tex., where it was noted on the 17th. Frost was reported on a number of dates in southern New Mexico and southern Arizona. On the Pacific coast frost was reported as far south as Los Angeles, Cal., where it was noted on the 6th, 7th, and 16th to 18th. Com-

pared with October, 1889, the southern limit of frost for the current month has extended nearly five degrees in the Atlantic coast states; about four degrees in Texas; and two to three degrees on the Pacific coast. For November, 1889, frost was reported in the south Atlantic and Gulf states, as follows: It was reported in the greatest number of states, nine, on the 29th; in eight on the 18th, 19th, and 30th; in seven on the 28th; in six on the 4th, 10th, 20th, and 23d; in five on the 3d, 15th to 17th, and 24th; in four on the 9th, and 12th to 14th; in three on the 11th, 22d, and 27th; in two on the 1st, 2d, 6th to 8th, and 21st; and in one on the 5th and 26th—the 25th was the only date on which no frost was reported in one or more of the south Atlantic or Gulf states. On the Pacific coast frost was reported in California on the 1st to 18th, and 23d to 25th; in Oregon on the 4th, 6th, 7th, and 14th to 16th; in Washington on the 1st, 3d to 6th, 13th to 16th, 18th, and 22d to 24th. Frost was reported on the greatest number of dates, twenty-four, in Louisiana; on twenty-one in California; on eighteen in Mississippi; on seventeen in North Carolina and Georgia; on fifteen in Alabama and Texas; on thirteen in Washington; on ten in South Carolina; on nine in Arkansas; on six in Oregon, and on four in Florida.

#### TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for November, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass.	51.1	44.3	6.8	48.2	44.6
Canby, Fort, Wash.	56.0	48.5	7.5	52.2	50.1
Cedar Keys, Fla.	76.3	45.9	27.4	66.1	64.3
Charleston, S. C.	67.3	55.0	12.3	63.4	60.0
Eastport, Me.	49.4	45.6	3.8	47.8	39.8
Galveston, Tex.	74.0	55.5	18.5	62.4	59.6
Key West, Fla.	81.5	69.7	11.8	77.6	76.0
Nantucket, Mass.	54.0	43.5	10.5	48.9	46.1
New York, N. Y.	52.1	45.9	6.2	50.0	46.9
Portland, Oregon	53.5	45.0	8.5	47.9	47.0

#### PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for November, 1889, as determined from the reports of nearly 2,000 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The greatest monthly precipitation reported for November, 1889, was 16.25, at Heber, Ark. Monthly precipitation to equal or exceed ten inches was reported in Siskiyou, Shasta, and Placer counties, Cal., east-central Texas, east-central Pennsylvania, northeastern Maryland, northern New Jersey, west-central Connecticut, and extreme southeastern New York. At Hess Road Station, N. Y., a monthly precipitation of 15.23 was reported. On the Pacific coast the monthly precipitation was greatest along the lines of the Southern Pacific Railroad Company in north-central and northeastern California, where it amounted to 11.65 at Dunsmuir, Siskiyou Co., 11.41 at Emigrant Gap, Placer Co., and 10.03 at Delta, Shasta Co., and least in southern and southeastern California, where it was less than one-half inch, and where at Indio, San Diego Co., but 0.01 was reported. In the plateau regions the monthly precipita-

tion was greatest in northern and southeastern Idaho, north-eastern Nevada, in areas in central Utah, and in south-central New Mexico, where it exceeded one inch, and where at Nogal, Lincoln Co., N. Mex., it amounted to three inches. In areas in the interior of Nevada, extreme northwestern Utah, and east-central Arizona no precipitation was reported. On the eastern slope of the Rocky Mountains the greatest amount of precipitation fell in central Colorado, where it exceeded four inches, and in extreme northwestern Wyoming, west-central Colorado, west-central Kansas, and north-central and extreme northern Texas, where it exceeded two inches. In Cheyenne county, Nebr., no precipitation was reported. In the central valleys the monthly precipitation was greatest in central Arkansas, where it varied in amount from ten to over sixteen inches, and least in the Dakotas, western Minnesota, and central Mississippi, where less than one-half inch fell, and where at stations in southeastern South Dakota trace was reported. In the Lake region the monthly precipitation exceeded five inches at stations in extreme south-central and southwestern Michigan and western New York, and was less than one inch on the west and northwest shores of Lake Superior. In the Atlantic coast states the monthly precipitation exceeded ten inches in areas in the middle Atlantic states and west-central Connecticut, and was less than one inch in north-central South Carolina, and extreme southwestern Georgia, and was less than one-half inch in central Florida.

The precipitation for November, 1889, was generally above the normal east of the Rocky Mountains, except on the northeastern slope, in the extreme northwest, and the lower Rio Grande valley; it was also above the normal on the middle Pacific coast. In the plateau regions, the upper Missouri valley, the north and south Pacific coasts, and the lower Rio Grande valley the precipitation was generally below the normal amount for the month. The greatest excesses in precipitation were noted in extreme southeastern New York and in central Arkansas, where they were more than six and five inches, respectively. On the North Carolina coast and in northwestern Louisiana the excesses were more than four inches; on the coast of western Maine, from western Connecticut to northeastern Virginia, extreme southern Florida, north-central Tennessee, and east-central Texas more than three inches. The greatest deficiencies in precipitation occurred on the coast of Oregon, where they were more than three inches. On the north coast of Florida and in extreme southern Louisiana the deficiencies were more than two inches. Considered by districts the average percentages of the normal precipitation in districts where the precipitation was in excess of the normal were about as follows: New England, 144 per cent.; middle Atlantic states, 170 per cent.; south Atlantic states, 109 per cent.; Florida Peninsula, 143 per cent.; east Gulf states, 115 per cent.; west Gulf states, 176 per cent.; Ohio Valley and Tennessee, 145 per cent.; lower lake region, 112 per cent.; upper lake region, 107 per cent.; upper Mississippi valley, 113 per cent.; middle-eastern slope of the Rocky Mountains, 160 per cent.; southeastern slope of the Rocky Mountains, 124 per cent.; middle Pacific coast, 111 per cent.

In districts where the precipitation was deficient the percentages of the normal were about as follows: Rio Grande Valley, 69 per cent.; extreme northwest, 66 per cent.; northeastern slope of the Rocky Mountains, 88 per cent.; southern plateau region, 44 per cent.; middle plateau region, 52 per cent.; northern plateau region, 50 per cent.; north Pacific coast, 79 per cent.; southern Pacific coast, 60 per cent. In the Missouri Valley the precipitation averaged normal.

A summary of the precipitation in the several districts from January 1 to November 30, 1889, inclusive, shows that in New England the total average amount for that period was 46.51, or 2.35 more than the average amount. In the middle Atlantic states the amount, 55.86, was 14.50 in excess of the normal. In the south Atlantic states, 52.42, deficiency, 0.18. Florida Peninsula, 47.87, excess, 3.73. East Gulf states, 48.21, deficiency, 6.66. West Gulf states, 43.90, excess, 2.42. Rio Grande Valley, 28.51, deficiency, 0.19. Ohio Valley and Tennessee, 38.10, deficiency, 5.37. Lower lake region, 28.47, deficiency, 4.19. Upper lake region, 27.43, deficiency, 4.69. Extreme northwest, 11.98, deficiency, 6.50. Upper Mississippi valley, 28.47, deficiency, 6.32. Missouri Valley, 23.61, deficiency, 3.58. Northeastern slope of the Rocky Mountains, 12.16, deficiency, 2.73. Middle-eastern slope of the Rocky Mountains, 23.75, excess, 2.12. Southeastern slope of the Rocky Mountains, 23.01, deficiency, 0.81. Southern plateau region, 9.31, deficiency, 2.17. Middle plateau region, 7.42, deficiency, 3.34. Northern plateau region, 11.50, deficiency, 4.17. North Pacific coast, 39.22, deficiency, 10.64. Middle Pacific coast, 22.15, excess, 4.12. South Pacific coast, 13.92, excess 1.56. The more notable features of the precipitation for this period are: the marked excess in the middle Atlantic states, where about one-third more than the usual amount of rain fell, and the deficiencies in the extreme northwest and the middle plateau region, where the total precipitation for the period was but about 66 per cent., in the northern plateau region, where it was about 73 per cent., and on the north Pacific coast, where it was about 80 per cent. of the normal amount for January to November, inclusive.

#### DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for No-

vember for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for November, 1889; (4) the departure of the current month from the average; (5) and the extreme monthly precipitation for November during the period of observation and the years of occurrence:

State and station.	County.					(5) Extreme monthly precipitation for November.			
		(1) Average for the month of Nov.		(2) Length of record.	(3) Total for Nov., 1889.	(4) Departure from average.	Greatest.		Least.
		Inches.	Years				Am't.	Year.	Am't.
<i>Arkansas.</i>									
Lead Hill .....	Boone .....	4.08	8	5-10	+1.02	5.77	1883	2.50	1885
<i>California.</i>									
Sacramento .....	Sacramento .....	2.02	39	3-49	+1.47	9.65	1885	0.00	50, '62
<i>Colorado.</i>									
Fort Lyon .....	Bent .....	0.28	18	.....	.....	1.50	1883	0.00	1870
<i>Connecticut.</i>									
Middletown .....	Middlesex .....	3.91	29	7-03	+3.12	7.29	1877	1.65	1882
<i>Florida.</i>									
Merritt's Island .....	Brevard .....	2.43	11	1.16	-1.27	5.67	1884	0.17	1886
<i>Georgia.</i>									
Forsyth .....	Monroe .....	3.51	15	5.28	+1.77	5.41	1888	1.01	1887
<i>Illinois.</i>									
Peoria .....	Peoria .....	2.32	33	2.91	+0.59	4.93	1879	0.31	1865
Riley .....	McHenry .....	2.31	38	2.34	+0.03	8.38	1876	0.06	1862
<i>Indiana.</i>									
Loganport .....	Cass .....	3.70	14	.....	.....	5.76	1881	1.43	1880
Vevay .....	Switzerland .....	3.19	24	6.06	+2.87	6.34	1888	0.73	1872
<i>Iowa.</i>									
Cresco .....	Howard .....	1.48	18	2.22	+0.74	5.20	1879	0.18	1875
Monticello .....	Jones .....	2.43	34	0.98	-1.45	5.72	1862	0.12	1865
Logan .....	Harrison .....	1.35	19	1.85	+0.50	3.85	1871	0.00	1873
<i>Kansas.</i>									
Lawrence .....	Douglas .....	1.90	23	1.96	+0.06	5.15	1879	0.01	1872
Wellington .....	Sumner .....	1.00	10	1.70	+0.70	1.98	1881	0.18	1886
<i>Louisiana.</i>									
Grand Coteau .....	St. Landry .....	3.41	6	2.85	-0.56	5.72	1883	1.86	1887
<i>Maine.</i>									
Orono .....	Penobscot .....	4.70	19	4.50	-0.20	8.76	1886	1.78	1882
<i>Maryland.</i>									
Cumberland .....	Allegany .....	2.12	18	5.34	+3.23	5.34	1889	0.82	1887
<i>Massachusetts.</i>									
Amherst .....	Hampshire .....	4.68	44	6.55	+1.87	7.48	1854	1.33	1882
Newburyport .....	Essex .....	4.18	11	5.15	+3.97	8.15	1889	0.97	1882
Somerset .....	Bristol .....	4.55	17	5.91	+3.36	9.03	1876	1.45	1882
<i>Michigan.</i>									
Kalamazoo .....	Kalamazoo .....	2.77	13	3.20	-0.57	5.77	1877	1.25	1882
Thornville .....	Lapeer .....	2.92	12	3.79	+0.87	4.90	1885	1.42	1882
<i>Minnesota.</i>									
Minneapolis .....	Hennepin .....	1.37	23	1.05	-0.29	4.13	1868	0.31	1878
<i>Montana.</i>									
Fort Shaw .....	Lewis Clarke .....	0.45	19	0.10	-0.35	0.89	1880	0.01	1877
<i>New Hampshire.</i>									
Hanover .....	Grafton .....	3.77	37	4.76	+0.99	6.62	1885	0.59	1882
<i>New Jersey.</i>									
Moorestown .....	Burlington .....	3.32	26	7.02	+3.70	7.02	1889	1.28	1882
South Orange .....	Essex .....	3.37	19	11.37	+5.00	11.37	1889	0.95	1883
<i>New York.</i>									
Cooperstown .....	Otsego .....	3.06	35	3.50	+0.44	5.38	1858	1.45	1876
Palermo .....	Oswego .....	3.65	35	4.11	+0.46	6.60	1866	1.01	1882
<i>North Carolina.</i>									
Lenoir .....	Caldwell .....	3.35	17	6.40	+3.05	7.60	1877	0.50	1880
<i>Ohio.</i>									
N. Lewishburg .....	Champaign .....	3.33	14	4.20	+0.87	5.75	1888	0.85	1884
Wauseon .....	Fulton .....	3.15	17	3.67	+0.52	5.83	1881	1.46	1884
<i>Oregon.</i>									
Albany .....	Linn .....	4.26	10	2.95	-1.31	8.40	1885	1.75	1886
Eola .....	Polk .....	4.38	19	3.23	-1.15	13.01	1877	1.45	1886
<i>Pennsylvania.</i>									
Derryberry .....	Wayne .....	3.21	18	5.80	+2.59	7.00	1886	1.40	1882
Grampian Hills .....	Clearfield .....	3.03	20	3.86	+0.83	6.03	1886	1.42	1872
Wellsborough .....	Tioga .....	4.32	10	9.07	+4.75	9.07	1889	2.35	1887
<i>South Carolina.</i>									
Statesburgh .....	Sumter .....	1.87	8	2.80	+0.93	3.90	1882	0.87	1886
Austin .....	Wilson .....	3.82	19	7.13	+3.31	7.24	1874	1.70	1887
Milan .....	Gibson .....	4.25	6	5.14	+3.89	8.65	1886	1.61	1884
<i>Texas.</i>									
New Ulm .....	Austin .....	5.12	17	3.83	-1.29	14.93	1873	0.48	1887
<i>Vermont.</i>									
Strafford .....	Orange .....	3.48	16	5.50	+2.03	6.20	1888	0.50	1874
Birdsboro .....	Northampton .....	2.98	20	5.05	+2.07	5.80	1885	0.40	1879
Madison .....	Dane .....	2.06	20	1.17	-0.89	4.92	1856	0.53	1870
Washington .....	Jefferson .....	2.88	14	1.55	-1.33	9.21	1874	0.39	1884

The above table shows that at Cumberland, Md., eighteen years record, the precipitation for the current month, 5.34, was the greatest ever reported at that place for November, the greatest previous November precipitation, 5.10, being noted in 1877. At Newburyport, Mass., eleven years record, the greatest November precipitation noted for preceding years, 6.74, in 1888, was 1.41 less than the amount reported for the current month; at Moorestown, N. J., twenty-six years

record, the amount for November, 1889, 7.02, was 0.72 greater than the greatest amount reported for the corresponding month of preceding years, noted in 1877; at South Orange, N. J., nineteen years record, the previous maximum precipitation for November, 6.62, in 1877, was 4.75 less than the precipitation reported for the current month; and at Wellsborough, Pa., ten years record, the precipitation for November, 1889, exceeded the greatest amount previously reported for November, 7.71, in 1886, by 1.36.

Table of excessive precipitation, November, 1889.

State and station.	Monthly rainfall to inches, or more.	Rainfall 2-50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.	
		Amt.	Day.	Amt.	Time.
Alabama.	Inches.	Inches.		Inches	h. m.
Bermuda		3.00	1		
Evergreen		2.56	21		
Mount Vernon Barracks		3.63	2		
Juneau		3.10	14		
Arkansas.					
Conway	13.17				
Heber	16.25				
Little Rock	10.20	3.15	7		
Do.	3.47	12-13			
Little Rock Barracks	11.26	3.31	7		
Malvern	12.34	2.60	12		
Monticello		2.91	12		
Newport (1)	10.17				
Newport (2)	13.30	3.30	7		
Russellville	11.25				
California.					
American Hill		2.90	20		
Crescent City		2.96	21		
Delta	10.03				
Dunsmuir	11.65				
Emigrant Gap	11.41				
Grass Valley		2.54	19		
Iowa Hill		2.72	20		
Sims	13.32				
Connecticut.					
Hartford (1)		3.40	27-28		
New Hartford (1)		3.30	27-28		
New Haven		2.62	27-28		
Shelton	10.03	4.85	27		
Wallingford		3.60	25		
Florida.					
Fort Barrancas		2.65	2		
Jupiter				1.00	100
Key West		4.52	9		
Pensacola		3.55	2		
Georgia.					
Columbus		2.50	17		
Illinois.					
Cairo		2.96	7-8		
Indiana.					
Huntingburgh		2.55	7		
Marengo		2.70	7		
Princeton		2.50	26		
Kansas.					
Brookville		2.50	7-8		
Mankato		3.50	1		
Kentucky.					
Springfield		2.50	13		
Louisiana.					
Columbia		3.00	7		
Do.		3.00	12		
Coushatta (1)		3.05	7		
Coushatta (3)		3.90	6		
Shreveport		3.37	6-7		
Maine.					
Fort Preble		4.30	27-28		
Kent's Hill		2.50	21-22		
Portland		3.40	27-28		
Maryland.					
Galena	10.17				
Massachusetts.					
Amherst		3.18	27-28		
Amherst Experimental Station (1)		3.12	27-28		
Fall River		2.75	27-28		
Fitchburg		2.58	28		
Leicester		3.09	27-28		
Newburyport		4.10	28		
Northampton		2.95	23		
Somerset		3.17	27-28		
Springfield Armory		2.65	27-28		
Westborough		3.25	27-28		
Worcester (1)		2.53	27-28		
Missouri.					
Hermann		3.20	1		
New Hampshire.					
Nashua		2.63	28		
New Jersey.					
Atlantic City		2.94	27-28		
Belleview	11.45	3.99	27		
Egg Harbor City		2.50	27-28		
Gillette	10.19				
Hanover	10.72				
Madison	10.20	2.91	9		
Newark		2.84	27		
New Brunswick		2.54	27-28		

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall to inches, or more.	Rainfall 2-50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.	
		Amt.	Day.	Amt.	Day.
<i>New Jersey—Continued.</i>					
Oceanic				3.21	27
Plainfield				3.40	8-9
South Orange				3.50	10
Do.				2.68	27
Union		10.56		3.17	8-9
<i>New York.</i>					
Ardenia				3.75	27-28
Boyd's Corners				3.69	27-28
Central Park, N. Y. City				3.65	9
David's Island				3.12	27-28
Fort Columbus				2.71	9
Do.				3.16	27-28
Fort Hamilton				2.50	9-10
Fort Schuyler				3.50	9
Do.				3.33	27
Fort Wadsworth				2.71	27-28
Hess Road Station				15.23	19
Madison Barracks				10.02	
New York City.				2.50	9
Do.				2.88	27-28
Setauket				3.00	
West Point				3.20	27-28
White Plains				11.66	5-04
Willet's Point				10.28	27-28
Do.				3.66	8-9
<i>North Carolina.</i>					
Lenoir				3.00	16-17
Mount Pleasant				3.05	16-17
<i>Pennsylvania.</i>					
Blooming Grove				2.60	27-28
DoylesTown				10.05	
Girardville				10.16	
Lancaster				2.66	18-19
Lock Haven				2.51	18-19
Myerstown				2.73	18-19
Nisbet				2.90	19
Quakertown				2.59	9
Selin's Grove				3.50	18-19
Wellsborough				3.96	19
West Chester				2.62	19
Smith's Corner				2.75	9
Westtown				2.90	19
<i>South Carolina.</i>					
Charleston				5.84	16-17
Clinton				2.50	16
Jacksonborough				3.05	17
Port Royal				3.15	16
Spartanburgh (1)				2.70	16-17
Winnisborough				2.75	17
Yorkville				2.51	17
<i>Tennessee.</i>					
Knoxville				3.07	8
Trenton				2.83	18
<i>Texas.</i>					
Brady				2.50	2
Brazoria				3.52	6
Columbia				2.85	5
Corsicana (2)				3.05	7
Tyler				10.49	
<i>Vermont.</i>					
Brattleborough (1)				2.93	28
<i>West Virginia.</i>					
Weston				2.82	14
<i>Excessive precipitation data received too late for publication in October, 1889, Review.</i>					
<i>California.</i>					
Arcata				2.89	7
Dunsmuir				20.15	
Tehama				11.15	

## EXCESSIVE PRECIPITATION.

For November, 1889, monthly precipitation to equal, or exceed, ten inches was reported at eight stations in Arkansas; at seven stations in New Jersey; at five stations in New York; at four stations in California; at three stations in Alabama; at two stations in Pennsylvania; and at one station in Connecticut, Maryland, and Texas. The greatest monthly precipitation reported was 16.25, at Heber, Ark.; elsewhere the precipitation for the month was less than fifteen inches, except at Hess Road Station, N. Y., where 15.23 inches were reported. In November of preceding years precipitation to equal, or exceed, ten inches has been reported most frequently in Oregon, where it was noted for twenty-one years. In Washington this amount has been equalled, or exceeded, in November for twenty years; in California for eleven years; in

Alabama, Massachusetts, Mississippi, and New York for from five to ten years, inclusive; and in Arkansas, Delaware, Florida, Georgia, Indiana, Kentucky, Louisiana, Maine, Maryland, Michigan, Missouri, New Hampshire, New Jersey, North Carolina, Texas, Virginia, and Wisconsin from one to four years, inclusive. In states and territories other than those named precipitation to equal, or exceed, ten inches in November has not been reported for preceding years. Among the heavier rainfalls reported for November of preceding years are: 31.93, at Crescent City, Cal., in 1885; 20.51, at Downieville, Cal., in 1859; 22.40, at Meadow Valley, Cal., in 1865; 24.12, at Georgetown, Cal., in 1875; 24.75, in 1865, and 24.54, in 1885, at Fort Gaston, Cal.; 29.38, at Delta, Cal., in 1885; 20.89, at Point Pleasant, La., in 1877; 22.21, at Fort Stevens, Oregon, in 1877; 27.60, at Neah Bay, Wash., in 1865; 20.70, at Tatoosh Island, Wash., in 1869. Exclusive of the instances and years cited, precipitation to equal, or exceed, fifteen inches has been reported for November for eight years in Washington; for seven years in Oregon; for four years in California; for two years in New Hampshire; and for one year, each, in Florida, Louisiana, and Maine.

Precipitation to equal, or exceed, 2.50 inches in twenty-four hours in November, 1889, was reported at fourteen stations in New York, on the 8th, 9th, 19th, 27th, and 28th; at eleven stations in Massachusetts, on the 27th and 28th; at eleven stations in Pennsylvania, on the 9th, 18th, 19th, 27th, and 28th; at ten stations in New Jersey, on the 8th to 10th, 27th, and 28th; at seven stations in South Carolina, on the 16th and 17th; at five stations in Arkansas, on the 7th, 12th, and 13th; at five stations in Connecticut, on the 27th and 28th; at four stations in California, from the 19th to 21st; at four stations in Louisiana, on the 6th, 7th, and 12th; at four stations in Texas, on the 2d, and 5th to 7th; at three stations in Alabama, on the 1st, 2d, and 21st; at three stations in Florida, on the 2d and 9th; at three stations in Indiana, on the 7th and 26th; at three stations in Maine, on the 21st, 22d, 27th, and 28th; at two stations in Kansas, on the 1st, 7th, and 8th; at two stations in North Carolina, on the 16th and 17th; at two stations in Tennessee, on the 8th and 18th; at one station in Georgia, on the 17th; at one station in Illinois, on the 7-8th; at one station in Kentucky, on the 13th; at one station in Missouri, on the 1st; at one station in New Hampshire and Vermont, respectively, on the 28th; and at one station in West Virginia, on the 14th. Among the heavier rainfalls reported for this period were: 4.85, at Shelton, Conn., on the 27th; 4.52, at Key West, Fla., on the 9th; 4.10, at Newburyport, Mass., on the 28th; 5.84, at Charleston, S. C., on the 16-17th; 5.04, at White Plains, N. Y., on the 27-28th; and 4.30, at Fort Preble, Me., on the 27-28th.

Precipitation to equal, or exceed, 2.50 inches in twenty-four hours in November of preceding years has been most frequently reported in Louisiana and Texas, where it has been noted for fifteen years. In North Carolina this amount in the period given has been equalled, or exceeded, for thirteen years; in Alabama, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Massachusetts, Mississippi, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee, and Washington, for from five ten years, inclusive; and in Arkansas, Arizona, California, Colorado, Delaware, District of Columbia, Indian Territory, Kentucky, Maine, Maryland, Michigan, New Hampshire, New Mexico, Rhode Island, South Carolina, Vermont, Virginia, and Wisconsin, from one to four years, inclusive. In states and territories other than those named precipitation to equal, or exceed, 2.50 inches in twenty-four hours has not been reported for November of preceding years. Among the heavier rainfalls reported for this period for November of preceding years are: 7.00, at Marion, Miss., 6-7th, 1885; 10.04, San Luis Obispo, Cal., 17-18th, 1885; 10.39, Fort Barrancas, Fla., 26th, 1878; 7.10, Point Pleasant, La., 20th, 1877; 7.00, Belmont Farm and Melissa, Tex., 1877. Exclusive of the instances and years cited, precipitation to equal, or exceed, five inches in the period given has been reported

in Texas for two years, and in Florida, Illinois, Louisiana, North Carolina, and Pennsylvania for one year.

The only report of precipitation to equal, or exceed, one inch an hour was 1.00 in one hour, at Jupiter, Fla., on the 17th. At Corpus Christi, Tex., 0.60 fell in twenty minutes on the 26th.

In November of preceding years precipitation to equal, or exceed, one inch in one hour has been reported for six years in Texas; for three years in North Carolina and Tennessee; for two years in California, Indiana, Mississippi, and New York; and for one year in Alabama, District of Columbia, Florida, Georgia, Kansas, Kentucky, Michigan, Nebraska, Pennsylvania, and Virginia. In states and territories other than those named precipitation to equal, or exceed, one inch in one hour in November has not been reported for preceding years. Among the heavier November rainfalls for one hour, or less, reported for preceding years are: 0.25, in two minutes, at New York, N. Y., 18th, 1886; 1.48, in fifteen minutes, at Galveston, Tex., 5th, 1877; 1.82, in twenty minutes, at Vicksburg, Miss., 15th, 1879; 3.50, in thirty minutes, at Galveston, Tex., 2d, 1873.

#### MAXIMUM RAINFALLS IN ONE HOUR OR LESS.

The following table is a record of the heaviest rainfalls during November, 1889, for periods of five and ten minutes and one hour, as reported by regular stations of the Signal Service furnished with self-registering gauges:

Station.	Maximum fall in—				
	5 min.	Date.	10 min.	Date.	1 hour.
					Date.
	Inch.		Inch.		Inch.
Bismarck, N. Dak.					
Boston, Mass.	0.05	19	0.10	19	0.32
Buffalo, N. Y.	0.03	2	0.05	2	0.20
Cincinnati, Ohio	0.04	8	0.08	8	0.30
Detroit, Mich.	0.03	2	0.05	2	0.15
Galveston, Tex.	0.05	16	0.06	16	0.16
Jupiter, Fla.	0.24	17	0.40	17	1.00
New York, N. Y.	0.08	27	0.15	27	0.47
New Orleans, La.	0.05	13	0.06	13	0.20
Norfolk, Va.	0.10	21	0.20	21	0.40
Savannah, Ga.	0.08	3	0.15	3	0.50
San Francisco, Cal.	0.07	18	0.14	18	0.32
Saint Louis, Mo.	0.10	26	0.12	26	0.20
Washington, D. C.	0.10	13	0.20	13	0.47

\* No record on account of snow. † Record incomplete on account of snow. ‡ Record not complete.

#### SNOW (snowfall in inches and tenths).

A remarkable feature for November was the heavy snow storm which prevailed in eastern Colorado, western Kansas, northeastern New Mexico, and extreme northern Texas during the early portion of the current month. This storm was most severe during the 4th, 5th, and 6th, when snow, attended by low temperature and high wind, caused loss of life and considerable damage to live stock. The snowfall was variously reported from one to two feet deep in northeastern New Mexico and adjacent parts of Colorado and Texas, and the drifts were sufficiently deep to seriously interfere with railroad traffic.

This storm attended the presence over the plateau and Rocky Mountain regions of an area of high pressure described as number 1 under the heading "Atmospheric pressure."

Mr. M. A. Upson, voluntary observer at Roswell, N. Mex., submits the following interesting report in connection with this storm:

The snow storm and blizzard along the line of the Pan Handle of Texas and the eastern line of New Mexico on the 4th, 5th, and 6th of November, 1889, although giving the heaviest fall of snow ever known this far south in the valley of the Rio Pecos, was comparatively light at this place, and there was but one portion of the day, on the 7th, that was excessively cold, the temperature falling to 12°. The weight of the storm in New Mexico fell on Colfax and Mora counties, in the extreme northeast of the territory, though it was more severe across the line in Texas. Crossing the Rio Pecos, east, the first bench of the plains, some fifty miles, like our valley, is protected by mountains on the north and west, and by the San Juan Range. As you reach the second bench the ascent is rapid until you reach an extensive flat "mesa" (table) where commences the Staked Plains (Llano Estacado). This "mesa" is literally unprotected from north, east, and northeast winds for hundreds of miles. Blasts from the north and east gather force, and, by the time they reach the thirty-seventh parallel of latitude, they are often

charged with frost, sleet, hail, and snow, killing to men and stock. In the storm of November the cow boys lost their lives at a point over two hundred miles from this place. Stock drifted before the storm and hundreds were driven in on to the Pecos. However, this year they were in good condition and the loss was not as heavy as was anticipated. Stock is always fat on the plains, and stock belonging on the river, which had strayed to the plains, fared the worst. As I said before, although severe, the severity and results of this storm have been very much exaggerated in public reports. The men who lost their lives were brave; they were holding beef cattle for shipment only a few miles from settlements when the herds commenced to drift, and it would have been easy to leave them to their fate and seek their own safety; but faithful to their employers, they tried to hold the stock together, and stayed with them until all trails were obliterated; blinding snow, driven with all the velocity of a Texas "norther," obscured air, earth, and sky, and, experienced plainsmen as they were, they were as helpless as babes. The courage and devotion of cow boys in the interests of their employers is little appreciated in the East. Hundreds of them have died at their posts within my twenty-six years experience in New Mexico.

The greatest depth of snowfall reported for the month was sixty-one inches, at Summit, Cal. At Breckenridge, Colo., forty-seven inches were reported; at Cisco, Cal., twenty-eight inches; at Roswell, N. Mex., twenty-nine inches; at Green Bay, Wis., twenty-two inches; at Blue Knob, Pa., twenty-two inches; and at Alpena, Mich., twenty-one inches. The snowfall for the month exceeded fifteen inches in east-central Arizona, northwestern Iowa, east-central Minnesota, extreme northern New York, northeastern Ohio, northeastern Oregon, and extreme northern Texas, and was more than ten inches in northeastern Illinois, central Kansas, western Montana, north-central Nebraska, northern New Hampshire, extreme south-central South Dakota, northeastern Vermont, and northwestern Wyoming. Snow in measurable quantities fell north of a line traced from extreme southern New Jersey, southwestward to northern Georgia, thence westward to central Arkansas, thence southwestward to central Texas, thence westward south of El Paso, Tex., thence irregularly northwestward to western Oregon, and east of this line continued northeastward to northeastern Washington.

Snowfalls of five inches or more were reported as follows, and in states and territories where the maximum depth was below that amount, the station reporting the greatest is given: *Alabama*.—Valley Head, trace. *Arizona*.—Cooley Springs, 16; Flagstaff and Holbrook, 5. *Arkansas*.—Lead Hill, 4. *California*.—Summit, 61; Cisco, 28; Truckee, 10.8; Boca, 9. *Colorado*.—Breckenridge, 47; Gunnison, 36; Leadville, 30; Emma, 28.5; Apishapa, 27.5; Frazer, 26.5; Ranch, near Como, 26.3; Fort Lewis, 21; Durango, 19; Georgetown, 18; Glenwood Springs, 17.5; Eagle Farm, 14; Magnolia, 13; Monto Vista, 12.5; San Luis Experimental Station, 11.5; Pueblo, 10.1; Cañon City and Rocky Ford, 10; Fort Logan, 9; Wigwam, 8.2; Byers and Brush, 7.8; Palmer Lake, 7.2; Idaho Spring, 7; Agate, 6; Denver, 5.8; Fort Collins, 5.6. *Connecticut*.—Mansfield, trace. *District of Columbia*.—Trace. *Georgia*.—Diamond, 2.5. *Idaho*.—Soda Springs, 9.5; Era, 9; Kootenai, 8. *Illinois*.—Watseka, 11.0; Greenville, 10.2; Jordan's Grove, 8.3; Centralia and Windsor, 8; Aurora, 7.8; Hilton, 7.2; McLeansborough, 6.5; Mascoutah, 6; Gibson City, Golconda, Rushville, and Woodstock, 5.5; Pontiac, 5. *Indiana*.—Angola, 6.6; Columbia City and Huntington, 6. *Indian Territory*.—Fort Reno, trace. *Iowa*.—Sac City, 15; Sioux City, 12; Wesley, 11; Logan, 10; Larrabee and Storm Lake, 8; Manson, 7; Cresco, 5.5. *Kansas*.—Gorham, 10; Concordia, Gove City, and Oakley, 6; Conway and Tribune, 5.4; Lakin, 5. *Kentucky*.—Shelbyville, 6.5; Lexington, 5.5; *Maine*.—Kent's Hill, 8; Cornish, Fairfield, Farmington, Lewiston, and West Jonesport, 7; Orono, 6; Mayfield, 5. *Massachusetts*.—North Billerica, 1. *Michigan*.—Buchanan, 23; Harrisonville, 22.5; Alpena, 21.3; Gladwin, 18.8; Cauldwell, 18; Albion, 17; Vandalia, 16.5; Lathrop, 16; Bangor, 15.3; Hastings, 14.7; Cassopolis, Fort Mackinac, Port Huron, and Crawford, 14; Weldon Creek, 13.5; Traverse City, 13.2; Berrien Springs, Parksville, Stanton, and West Branch, 13; Marshall, 12.7; Arbela, 12.5; Benton Harbor, Ivan, North Aurelius, Ovid, Paw Paw, and Saint John, 12; Fitchburgh and Mottville,

11; Lansing *b*, 10.8; Concord, 10.6; Alma, Berlin, Deer Lake, Eden, and Grayling, 10.5; Allegan, Ball Mountain, Birmingham, Chase, Evart, Grand Rapids, Gulliver Lake, Thornville, and Vienna, 10; Fremont, 9.8; Lansing *a* and Olivet, 9.5; Adamsville, Clinton, Colon, and Washington, 9; Bear Lake, Big Rapids, Highland Station, Kalamazoo, Manistee, Mio, Roscommon, Stockbridge, and Traverse City *b*, 8; Bronson, 7.5; Hayes, Hudson, Jedd, and Pontiac, 7; Calumet, 6.8; Fort Brady and Sault de Sainte Marie, 6.4; Bell Branch, 6; Manchester, Marquette, and Ypsilanti, 5.5; Ann Arbor, Atlantic, and Hillsdale, 5. *Minnesota*.—Pokegama Falls, 16.8; Rolling Green, 16; Farmington, 13; Lake Winnibigoshish, 12.2; Owatonna, 10.5; Leech Lake, 10.4; Red Wing, 10.2; Mankato, 9.7; Saint Charles, 9.5; Saint Vincent, 9; Minneapolis, 8.6; Duluth, 8.4; Le Seur, 7.8; Northfield, 7.7; Grand Meadow, 7.5; Pine River, 6; Osseo, 5.5. *Mississippi*.—Corinth and Holly Springs, 2. *Missouri*.—Saint Charles, 8; Ironton, 6. *Montana*.—Virginia City, 11.8; Fort Missoula and Helena, 11; Fort Maginnis, 9.2; Glendive, 6. *Nebraska*.—De Soto, 13.8; Kennedy, 12; Marquette, 10.5; Craig, 9.8; Fort Assinniboine, 7.3; Genoa, 7; Fort Niobrara, 6. *Nevada*.—Toano, 10.2. *New Hampshire*.—Berlin Mills, 14; West Milan, 8; Hanover *a* and North Conway, 7; Hanover *b*, 6; North Chesterfield, 5. *New Jersey*.—Oceanic, 0.5. *New Mexico*.—Nogal, 30; Roswell, 29; Las Vegas, 23; Chama, 16; Gallinas Spring, 13; Hillsborough, 12; Fort Stanton, 10; Deming and Fort Wingate, 5. *New York*.—Turin, 15.8; Constableville, 14; Canton, 13.7; North Hammond, 12; Plattsburgh Barracks, 11.1; Oswego, 10.2; Palermo, 10; Humphrey and Potsdam, 9.5; Buffalo, 8; Utica, 7; Number Four and Queensbury, 6; Saranac Lake, 5.8; Rochester, 5.7; Angelica, 5.5; Eden, 5. *North Carolina*.—Hot Springs, 2. *North Dakota*.—Fort Buford *a*, 5.6; Fort Buford *b*, 5.4. *Ohio*.—Bement, 15; Jefferson, 14.4; Wauseon, 9.5; Kent, 9; Cleveland, 8.3; Carrollton, 7; Napoleon, 6; Elyria and Kenton, 5.2. *Oregon*.—Joseph, 16; Baker City, 10; Telocaset, 9; Siskiyou, 8; North Powder, 6.5; The Dalles, 5. *Pennsylvania*.—Blue Knob, 21.9; Edinbororough, 6. *South Carolina*.—Simpsonville, trace. *South Dakota*.—Fort Randall, 11; Canton, 10.8; Fort Meade, 7. *Tennessee*.—Rugby and Trenton, 5. *Texas*.—Hartley, 16; Panhandle, 9; Epworth, 8; Fort Elliott, 7.2; Ochiltree, 6; El Paso, 5.4. *Utah*.—Mount Pleasant, 6. *Vermont*.—Chelsea and Weathersfield Centre, 10; Hartland, 8; East Berkshire, 7.5; Northfield and Strafford, 6; Saxton's River, 5. *Virginia*.—Bolar, 1.5. *Washington*.—Spokane Falls, 2.1. *West Virginia*.—Buckhannon, 6; Tannery, 5.5. *Wisconsin*.—Green Bay, 22.3; Summit Lake, 13; Embarrass, 9.8; Butternut, 9; Grantsburgh, 6.9; Wauconsta, 6.5. *Wyoming*.—Camp Sheridan, 12.3; Saratoga, 10; Fort Bridger, 12.3; Sundance, 8.6; Camp Pilot Butte, 8; Fort Washakie, 7.1; Lusk, 7; Cheyenne, 6; Carbon and Carter, 5.

#### DEPTH OF SNOW ON GROUND AT CLOSE OF MONTH.

Chart iv shows the depth of snow reported on the ground at the close of the month. Snow was generally reported on the ground on the last day of the month in New England north of Massachusetts, with a depth of from four to six inches in the interior of Maine and the more northern parts of New Hampshire and Vermont. In New York twelve inches were reported near the eastern extremity of Lake Ontario. In Pennsylvania, seven inches at Blue Knob. In the upper lake region, fifteen inches at Alpena, Mich., and more than ten inches in extreme southwestern Michigan. In Minnesota, nine inches at Pokegama Falls. East of the Mississippi River the line of appreciable snowfall extended southward into Tennessee. In Colorado twenty inches were reported at Breckenridge; elsewhere west of the one hundredth meridian no snow was reported on the ground at the close of the month, except along the northern border of the United States, in extreme western Nebraska, central Colorado, southwestern Montana, and in Idaho.

#### HAIL.

Hail was reported during the month as follows: 2d, N. Y.

4th, Ariz. 5th, Ariz., Tex. 7th, Kans. 9th, Pa. 10th, Mass. 12th, Tenn., Wash. 13th, Utah. 16th, Ala., N. J., S. C., Tenn. 17th, Ill., N. C., Ohio, Tenn. 18th, Cal. 19th, N. C., Oregon, Wash. 20th, N. Y., Oregon, Wash. 21st, Va., Wash. 22d, Cal., Utah, Va. 23d, N. Y., Wash. 25th, Kans. 26th, Ill., Md., Mo., Ohio. 27th, Mass., N. Y., Pa. 28th, Iowa, Kans., Me., N. Y., Vt. 29th, Mass., R. I.

## SLEET.

Sleet was reported as follows: 1st, Wis. 2d, Nebr., N. Dak.

4th, Ariz., Ind. T., N. Y. 5th, Tex., Vt. 7th, Ind., Kans., Tenn., W. Va. 10th, Idaho, Me., N. H. 12th, Tex., Wis. 14th, Pa. 15th, Ohio, Pa., Tex. 16th, Ind., Ky., N. Y., N. C., S. C., Tenn. 17th, Ala., Ill., Ind., N. Y., Ohio, Tenn., Va., W. Va. 18th, Pa., Tenn., W. Va. 19th, Ga., Mont. 20th, Tex. 21st, N. Y. 22d, Utah. 23d, Conn., Wis. 25th, Conn., Kans., Utah. 26th, Ill., Ind., Kans., Mo., Ohio, Pa. 27th, Ill., Ind., Mass., N. H., N. Y., Pa., Tenn., Wis. 28th, Colo., Ga., Ill., Me., N. H., N. Y., Tenn., Vt. 30th, Wis.

## WINDS.

The prevailing winds during November, 1889, are shown on chart ii by arrows flying with the wind. In New England, the middle Atlantic, south Atlantic, and east Gulf states, in the Ohio Valley and Tennessee, and the lower lake region, on the northeastern slope of the Rocky Mountains, and in the middle plateau region, the prevailing winds were westerly; in Florida, northerly; in the west Gulf states, the upper lake region, the extreme northwest, the upper Mississippi and Missouri valleys, and on the southeastern slope of the Rocky Mountains, north to northwest; over the northern plateau region, southeast to southwest; on the north Pacific coast, south to east; on the south Pacific coast, north to east; and in the Rio Grande Valley, on the middle-eastern slope of the Rocky Mountains, over the southern plateau region, and on the middle Pacific coast, variable.

## HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour were reported at regular stations of the Signal Service as follows: Fort Canby, Wash., 88, s., 17th; 68, s., 25th; Wood's Holl, Mass., 63, se., 28th; Eastport, Me., 60, e., 28th; Block Island, R. I., 60, e., 28th; Winnemucca, Nev., 58, s., 22d; New London, Conn., 54, se., 28th; Galveston, Tex., 54, nw., 26th; Fort Elliott, Tex., 54, n., 20th; 50, n., 11th; Buffalo, N. Y., 52, sw., 3d; Fort McKinney, Wyo., 50, w., 22d.

## LOCAL STORMS.

No severe thunder-storms were reported during the month. Press reports state that a destructive storm moving from the southwest passed over New Berne, N. C., at 1 p. m. on the 21st, causing loss of life and considerable damage to property, and that on the 28th a destructive storm passed over the northern part of Beaufort Co., N. C., cutting a swath half a mile wide through timber, prostrating buildings, and causing considerable loss of life. During the 27th and 28th severe gales prevailed over the Lake region, New York, and New England. C. L. Bozell, observer, Signal Corps, Sault de Sainte Marie, Mich., reports that high northeasterly winds, accompanied by fine, blinding snow, prevailed during the 27th

and 28th, with maximum wind velocity thirty miles per hour on the 28th; that the storm was unusually severe on the lakes, and that a number of vessels were wrecked. W. H. Andy, observer, Signal Corps, Marquette, Mich., reports that the wind increased to twenty-six miles per hour at 2.45 p. m., 26th, and was accompanied by light and heavy snow until the morning of the 28th; that the light-house was washed from its moorings, and considerable damage was done to the breakwater. H. L. Boyce, observer, Signal Corps, Port Huron, Mich., reports that a severe and almost continuous gale prevailed from the 26th to 30th, and that owing to the heavy snow it was the most dangerous experienced in that locality for years; maximum wind velocity thirty-four miles per hour at 8.05 a. m., 27th. T. F. Schley, observer, Signal Corps, Green Bay, Wis., reports that the wind reached a velocity of sixty miles per hour from the north on the 27th; that the gale was accompanied by snow, and that many disasters were reported on the lakes. S. W. Rhode, observer, Signal Corps, Milwaukee, Wis., reports that the northeast gale of the 27th and the northwest gale of the 28th, with maximum velocity thirty-seven and forty-two miles per hour, respectively, were quite severe, and caused very high seas on Lake Michigan; that a large number of vessels, with valuable cargoes, were ashore near "the straits;" that several serious disasters occurred off Chicago, and that none of the regular line steamers left the port of Milwaukee during those dates. H. C. Frankenstein, observer, Signal Corps, Chicago, Ill., reports that a severe gale prevailed throughout the day of the 28th, reaching a maximum velocity of thirty-seven miles per hour, and that numerous vessels were disabled on Lake Michigan. Dr. E. U. Jones, voluntary observer, Taunton, Mass., reports that a terrific gale prevailed at that place during the night of the 27-28th. Paul Daniels, observer, Signal Corps, New London, Conn., reports that a severe wind storm prevailed from the evening of the 27th to the morning of the 28th, with a maximum velocity of fifty-four miles per hour at 3.10 a. m., 28th, and that the tide was unusually high in the harbor during the day of the 28th. The snow storms of the month are referred to under the heading "Snow," in the chapter on "Precipitation."

## INLAND NAVIGATION.

## ICE IN RIVERS AND HARBORS.

The following notes relative to ice in rivers and harbors have been made by observers of the Signal Service:

*Mississippi River.*—La Crosse, Wis.: floating ice in river 18th to 20th, 24th, 25th, 27th, 29th, and 30th. The steam ferry boat "Warsaw" stopped running on the 29th, owing to ice. Saint Paul, Minn.: floating ice in river 16th, 17th, 24th, and 25th. The river was entirely gorged with ice on the 30th. Keokuk, Iowa: ice began running in the river on the 28th, and the steamer "Patience" laid up on that date, closing navigation for the season. Dubuque, Iowa: the river was full of floating ice on the 28th, and froze over on the 29th.

*Missouri River.*—Fort Buford, N. Dak.: floating ice in river 12th to 14th. The river froze over on the 15th, and remained

closed until the end of the month. Fort Yates, N. Dak.: the river was closed to navigation by ice on the 25th. Yankton, S. Dak.: the river froze over on the 27th, and navigation is closed for the season.

*Red River of the North.*—Saint Vincent, Minn.: the ferry boat laid up for the season on the 22d, on account of ice.

## FLOODS.

Press reports state that the rivers at Johnstown, Pa., reached the danger-point and overflowed their banks on the 9th, causing considerable damage to railroad and other property. From the 17th to the 21st damaging floods and washouts, resulting from heavy rains, occurred at various points in Pennsylvania, New Jersey, and southern New York. The severe rain storm of the 27th and 28th resulted in serious washouts on railroads,

the overflow of many streams, and the destruction of mill and other property in New England, New Jersey, and Delaware.

#### STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during November, 1889, with the dates of occurrence and the monthly ranges:

*Heights of rivers above low-water mark, Nov., 1889, (in feet and tenths).*

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La....	29.9		30	17.8		
<i>Arkansas River:</i>						
Fort Smith, Ark....	22.0		28	9.6		
Little Rock, Ark....	23.0		30	14.3		
<i>Missouri River:</i>						
Fort Buford, Dak....	15		1.1	7, 12, 13, 14	—0.3	1.4
Kansas City, Mo....	21.0		11	6.4	29	4.2
<i>Mississippi River:</i>						
Saint Paul, Minn....	14.5		5	1.9	24	1.1
La Crosse, Wis....	24.0		3, 4	1.9	1, 8—12, 20, 21	0.2
Dubuque, Iowa....	16.0		13	2.0	4, 5, 29, 30	0.4
Davenport, Iowa....	15.0	12—16, 23, 24	24	0.9	30	0.6
Keokuk, Iowa....	14.0	10—12	0.4	5, 6, 7, 8, 29, 30	0.0	0.4
Saint Louis, Mo....	32.0		14	10.6	1	3.7
Cairo, Ill....	40.0		23	28.9	1	4.2
Memphis, Tenn....	34.0		25	22.5	3, 2, 3	3.2
Vicksburg, Miss....	41.0		30	26.0	1, 2	—0.8
					20.8	

#### Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Miss. R.—Cont'd.</i>						
New Orleans, La....	13.0		30	7.2		5
<i>Ohio River:</i>						
Pittsburgh, Pa....	22.0		10	14.4		2
Parkersburg, W. Va....	38.0		26	19.5		3
Cincinnati, Ohio....	50.0		28	33.6		1
Louisville, Ky....	25.0		28	12.9		6.0
<i>Cumberland River:</i>						
Nashville, Tenn....	40.0		19	24.7		5
<i>Tennessee River:</i>						
Chattanooga, Tenn....	33.0		11—21	11.3		1, 2
<i>Monongahela River:</i>						
Pittsburgh, Pa....	29.0		10	14.4		2
<i>Savannah River:</i>						
Augusta, Ga....	32.0		22	17.1		3—10
<i>Willamette River:</i>						
Portland, Oregon....	15.0		27, 28, 29	4.3		19
					0.3	4.0

The Signal Service observer at Fort Sully, S. Dak., reports, under date of the 20th, that the water in the Missouri River at that place was lower than it had been at any time during the last eighteen years, and that navigation was suspended in consequence. At Chattanooga, Tenn., navigation was opened on the Tennessee River on the 4th, and driftwood was floating in the river on the 10th and 11th.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

Well-defined auroral displays were noted at Fort Buford, N. Dak., on the 1st; at Moorhead, Minn., Marquette, Mich., Northfield, Vt., and Eastport Me., on the 17th; at Fort Buford, N. Dak., Eastport and Portland, Me., and Northfield, Vt., 26th.

Fort Buford, N. Dak.: an aurora was first observed at 12.08 a. m., 1st; it consisted of a well-defined arch of yellowish light, which rose to about altitude  $45^{\circ}$ , the centre of which extended over about  $70^{\circ}$  between the northwest and northeast; beneath the arch was a diffused gray light, covering the space between the horizon and the arch. The lower portion of the aurora was partly obscured by stratus clouds. The maximum intensity occurred at 1.46 a. m., after which the arch gradually disappeared, and at 2.22 a. m. the display had entirely vanished. Auroral streamers, rising to altitude  $60^{\circ}$ , were observed in the north and northeast between 10.05 p. m. and 10.52 p. m., the same date. Another auroral display occurred on the evening of the 26th. It was first observed at 10.08 p. m., and consisted of a feeble gray light in the form of an arch, the western portion of which was about  $30^{\circ}$  above the horizon, from which point it extended eastward in a gradual slope, covering about  $130^{\circ}$  of the horizon. The display lasted until dawn of the 27th.—*Report of A. Schneider, observer, Signal Corps.*

Moorhead, Minn.: a faint auroral display was observed at 8.30 p. m., 17th. It consisted of a steady white arch of light, extending from azimuth  $170^{\circ}$  to  $220^{\circ}$ ; the altitude of which was about  $15^{\circ}$ . The aurora continued as described until day-light of the 18th.—*Report of S. L. Dosher, observer, Signal Corps.*

Marquette, Mich.: an aurora was observed at 7.30 p. m., 17th. It consisted of a pale white arch, extending from north-northwest to north-northeast, from which at 8.40 p. m. streamers rose to a height of about  $50^{\circ}$ . The display was of ordinary brilliancy and ended at 11 p. m.—*Report of Wm. H. Andy, observer, Signal Corps.*

Eastport, Me.: a faint auroral arch was observed at 7.45 p. m., 17th. It extended from northeast to a little west of north and to altitude  $10^{\circ}$ . The aurora extended farther westward and attained its maximum brilliancy at 9.30 p. m., when beams of light rose to near the zenith. At 9.50 p. m. the aurora consisted of a well-defined arch of altitude  $15^{\circ}$ , and had entirely disappeared at midnight. Another auroral arch of altitude  $15^{\circ}$  was observed at 5.30 p. m., 26th; it remained faint until

6.30 p. m., when it appeared to separate into two arches, the upper one having an altitude of  $12^{\circ}$  and the lower an altitude of  $8^{\circ}$ ; the upper extending from northeast to northwest. At 6.35 p. m. the display was quite brilliant, and shafts of light were shooting up from all parts of the arch. At 8 p. m. the arch was well defined and attained an altitude of  $30^{\circ}$ , extending from east-northeast to northwest. The display ended at 11 p. m.—*Report of D. C. Murphy, observer, Signal Corps.*

Northfield, Vt.: a faint auroral display was observed at 7.45 p. m., 17th. It consisted of a white light extending from azimuth  $180^{\circ}$  to  $225^{\circ}$ . At 7.55 p. m. the light had moved towards the east, its position being then from azimuth  $215^{\circ}$  to  $235^{\circ}$  and altitude  $15^{\circ}$ , with occasional streamers which rose to about  $30^{\circ}$  above the horizon. The display ended at 9 p. m. Another auroral arch was observed between 7.30 p. m. and 9 p. m., 26th, its color being similar to the morning dawn. The arch extended from azimuth  $135^{\circ}$  to  $225^{\circ}$  and to altitude  $35^{\circ}$ , with numerous small clouds in the upper portion of the arch.—*Report of William Line, observer, Signal Corps.*

Portland, Me.: an auroral arch was observed at 7.45 p. m., 26th. The arch was moderately luminous and fairly defined; it extended from about azimuth  $158^{\circ}$  to  $202^{\circ}$  and to altitude  $12^{\circ}$ . The arch gradually faded away at about 9.30 p. m.—*Report of N. D. Lane, observer, Signal Corps.*

Auroras were observed during the month as follows: 1st, Fort Buford, Leech Farm, and New England City, N. Dak.; Webster, S. Dak. 2d, Egg Harbor City, N. J.; South Canisteo, N. Y. 5th, 6th, and 8th, Huron, S. Dak. 11th, Princeton, Ind. 14th, 15th, Webster, S. Dak. 16th, Cornish, Me.; Leech Farm, N. Dak.; Yankton, S. Dak. 17th, Southington, Conn.; Leicester, Mass.; Cornish, Eastport, and Orono, Me.; Marquette, Mich.; Montevideo, Moorhead, and Pine River, Minn.; Glendive, Mont.; Spencerport and Wedgewood, N. Y.; Leech Farm and New England City, N. Dak.; Webster, S. Dak.; Northfield, Vt. 18th, Cornish, Me.; Montevideo, Minn.; Nashua, N. H.; Leech Farm, N. Dak. 19th, Ilion, N. Y. 20th, Farmington and Orono, Me. 21st, Orono, Me. 24th, Ozark, Mo. 25th, Orono, Me. 26th, Kootenai, Idaho; Eastport and Portland, Me.; Leicester and Newburyport, Mass.; Glendive, Mont.; Egg Harbor City, N. J.; Nashua, N. H.; Ardenia, Honey Mead Brook, and Queensbury, N. Y.; Fort Buford, N. Dak.; Huron, Kimball, and Wolsey, S. Dak.; Northfield, Vt.

27th, Postdam, N. Y.; Wolsey, S. Dak. 28th, Webster, S. Dak.; Hartland, Vt. 29th, Ardenia, N. Y.; Leech Farm and Wapeton, N. Dak.; Webster, S. Dak.; Newburyport, Mass. 30th, Manitowoc, Wis.

#### THUNDER-STORMS.

No severe thunder-storms were reported during the month. Thunder-storms were reported in the greatest number of states and territories, ten, on the 1st and 27th; in six on the 20th, 21st, and 25th; in from one to five, inclusive, on the 2d to 9th, 11th, 12th, 15th to 19th, 22d, 23d, 24th, 26th, 28th, 29th, 30th.

The 10th, 13th, and 14th were the only dates on which no thunder-storms were reported.

Thunder-storms were reported on the greatest number of dates, thirteen, in Texas; on nine in Louisiana; on six in Kansas; and on from one to five, inclusive, in Alabama, Arkansas, California, District of Columbia, Florida, Georgia, Illinois, Indiana, Indian Territory, Maryland, Mississippi, Missouri, Montana, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and Washington. In states and territories other than those named above no thunder-storms were reported.

#### MISCELLANEOUS PHENOMENA.

##### PRAIRIE FIRES.

Prairie fires were reported as follows: Fort Reno, Ind. T., 10th, 13th, 17th, 18th 21st, 22d, and 23d; Fort Sill, Ind. T., 13th to 16th and 18th to 23d, inclusive; Rhome, Tex., 19th; Sacramento, Cal., brush fires, 2d.

##### HALOS.

Solar halos were most frequently reported in Illinois, where they were noted on ten dates; in Tennessee on eight dates; in Missouri, on seven dates; in Minnesota, New York, and Ohio, on six dates; and on from one to five dates, inclusive, in Arizona, Arkansas, California, Colorado, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Nebraska, Nevada, New Jersey, North Carolina, North Dakota, Pennsylvania, South Carolina, South Dakota, Utah, Virginia, and Washington. In states and territories other than those named no solar halos were reported. They were reported in the greatest number of states and territories, nine, on the 5th and 26th; in seven on the 7th; in six on the 15th; and in from one to five, inclusive, on the 1st to 4th, 6th, 8th to 14th, 16th, 18th to 21st, 23d, 24th, 25th, 27th to 30th. No solar halos were reported on the 17th and 22d.

Lunar halos were most frequently reported in Nevada, where they were noted on fourteen dates, and in California on twelve dates; on from six to nine dates, inclusive, in Illinois, Iowa, Michigan, Montana, Nebraska, Oregon, South Carolina, South Dakota, Tennessee, and Virginia; and on from one to five dates, inclusive, in Alabama, Arizona, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming. In states and territories other than those mentioned, no lunar halos were reported. They were reported in the greatest number of states and territories, sixteen, on the 6th and 7th; in from eleven to fifteen, inclusive, on the 1st, 4th, 10th, 11th, and 29th; in from six to ten, inclusive, on the 2d, 3d, 5th, 8th, 9th, 12th, 27th, 28th, and 30th; and in from one to four, inclusive, from the 13th to 19th, and 26th. For dates other than those named no lunar halos were reported.

##### METEORS.

The distribution of meteors, by dates, was as follows: 1st, Richmond, Ind. 2d, Elyria and Westerville, Ohio. 3d, Auburn, Ala.; Villa City, Fla. 4th, Auburn, Ala.; North Sutton, N. H.; Setauket, N. Y.; Pittsburgh, Pa. 6th, New Castle, Pa. 8th, Whipple Barracks, Ariz. 10th, Vevay, Ind.; Webster City, Iowa; Alpena, Mich.; Egg Harbor City, N. J.; Quakertown, Pa. 11th, Statesburgh, S. C. 13th, Villa City, Fla.; Rolling Green, Minn.; Spearfish, S. Dak. 14th, Little Rock, Ark.; Red Bluff, Cal.; Villa City, Fla.; Barren Creek Springs, Md.; Quakertown, Pa.; Spearfish, S. Dak. 15th, Red Bluff, Cal.; State College, Pa. 16th, Kootenai, Idaho; Mount Saint Mary's, Md.; Woodbury, N. J.; Webster, S. Dak. 17th, Orono, Me.; Taunton, Mass. 18th, Bendena, Kans. 20th, Egg Harbor City, N. J. 22d, Villa City, Fla.; Uni-

versity, Miss.; Statesburgh, S. C.; Nashville and Riddleton, Tenn. 23d, Yates Centre, Kans.; Egg Harbor City, N. J.; Fort Washakie, Wyo. 24th, Webster City, Iowa; Factoryville, N. Y.; Centre Valley, Pa.; Spartanburgh, S. C. 25th, Berkeley, Cal. 28th, River Side, Cal.; Clinton, Iowa. 29th, Villa City, Fla.; Hilton, Ill.; North Sutton, N. H.; Albany, Oregon.

Elyria, N. Y.: a very large and brilliant meteor, about the apparent size of Jupiter, was observed at 6.15 p. m., 2d. It came from the southwest, and when near the ground it broke, sending out a shower of sparks.—*Report of Chas. W. Goodspeed, voluntary observer.*

Alpena, Mich.: a brilliant meteor was observed at 6.50 p. m., 10th. It passed across the sky from south to north about 30° above the horizon, and was visible about twelve seconds.—*Report of James J. Fitzgerald, observer, Signal Corps.*

Little Rock, Ark.: two very brilliant meteors were observed on the evening of the 14th. Both were moving from south to north, leaving trails of light in their paths.—*Report of W. U. Simons, observer, Signal Corps.*

Fort Sully, S. Dak.: a brilliant meteor was observed at 8.30 p. m., 17th. It dropped from altitude 10° and azimuth 135° below the horizon. The meteor appeared quite near, and illuminated the western sky with a distinct red light. Another brilliant meteor was observed in the eastern sky, passing from about altitude 25° to 15°, at 7.40 p. m., 30th, leaving a distinct trail in view.—*Report of I. G. Gardiner, observer, Signal Corps.*

Yates Centre, Kans.: a meteor was observed at 5.20 a. m., 23d, in azimuth 165°, altitude 45°. It passed diagonally toward the northeast, and disappeared in azimuth 190°, altitude 35°. It was of a pale yellow color, and left a quickly-vanishing trail.—*Report of Mr. F. R. Gray, voluntary observer.*

Berkeley, Cal.: a meteor of medium brightness was observed on the 25th, at 8.40 p. m. It started in the eastern sky and moved south at an angle of 40°. It was of short duration, and moved slowly.—*Report of Mr. Carl Rabe, voluntary observer.*

Palestine, Tex.: a brilliant meteor, moving from east to west, was observed in the northern sky at 11.15 p. m., 27th. It travelled about 25° before disappearing.—*Report of H. H. Curley, observer, Signal Corps.*

##### MIRAGE.

Mirage were observed as follows: 5th, Rolling Green, Minn.; 7th, Saint Vincent, Minn.; 8th, Kimball and Woonsocket, S. Dak.; 9th, Paoli, Colo., Webster, and Woonsocket, S. Dak.; 14th, Paoli, Colo.; 16th, Paoli, Colo., New England City, N. Dak.; 17th, New England City, N. Dak.; 18th, Yuma, Ariz., New England City, N. Dak., Kimball, S. Dak.; 19th, Kimball and Webster, S. Dak.; 22d, Paoli, Colo.; 25th, Yuma, Ariz., Bancroft, Iowa, Rolling Green, Minn., Kimball, S. Dak., San Diego, Cal.; 27th, Yuma, Ariz.

Saint Vincent, Minn.: a mirage was observed at 8 a. m., 7th. The towns of Hamilton and Bathgate, N. Dak., distant, respectively, eighteen and twenty-three miles from this place, were plainly seen. The buildings in each town were distinctly presented to view, as if seen from an adjacent eminence. A train of freight cars on the side track at Hamilton, and the

difference between the cattle and freight cars, as well as the spaces between the cars, were plainly distinguishable. The background of the whole showed an excellent view of the Pembina Mountains, twenty miles farther off. The phenomenon vanished at 9.20 a.m. Another mirage, presenting some Dakota town to view, was observed on the 19th.—*Report of R. J. Boylan, observer, Signal Corps.*

Duluth, Minn.: a mirage was observed at 7 a.m., 11th. About forty miles of the Wisconsin shore of Lake Superior and the mouth of the Bryle River were plainly visible.—*Report of W. H. Fallon, observer, Signal Corps.*

#### SAND STORMS.

Sand storms were reported as follows: San Diego, Cal., 4th; Wilcox, Ariz., 11th, 18th; Fort Verde, Ariz., 11th.

#### SUN SPOTS.

Mr. M. A. Veeder, Lyons, N. Y.: 1st, 2d, 3d, and 4th groups of faculae appeared by rotation; portions of these groups were seen near the western limb on the 14th, and returned again by rotation at the eastern limb on the 26th and 27th. On the 12th, 14th, and 17th, other groups of faculae appeared by rotation. Observations were lacking on the 5th, 7th, 8th, 9th, 11th, 13th, 15th, 18th, 19th, 21st, 22d, 23d, 24th, 25th, 28th, 29th, and 30th.

Mr. C. E. Buzzell, Leaf River, Ill.: no spots were observed during the month. Clouds prevented solar observations on the 1st, 2d, 5th, 7th, 8th, 9th, 20th, 21st, and 22d.

Mr. John W. James, Riley, Ill.: none seen during the month. Mr. H. D. Gowey, North Lewisburgh, Ohio: no sun spots were seen during the month.

Haverford College Observatory, Pa., (observed by Prof. F. P. Leavenworth):

Date.	Number of new—			Disappeared by solar rotation.	Reappeared by solar rotation.	Total number visible.	Remarks.	
	Groups.	Spots.	Groups.					
Nov., 1889.								
1, 10 a.m. ...	0	0	0	0	0	0	0	...
3, 5 p.m. ...	0	0	0	0	0	0	0	...
4, 12 m. ...	0	0	0	0	0	0	0	...
5, 9 a.m. ...	0	0	0	0	0	0	0	...
6, 9 a.m. ...	0	0	0	0	0	0	0	...
7, 9 a.m. ...	0	0	0	0	0	0	0	...
10, 10 a.m. ...	0	0	0	0	0	0	0	...
12, 9 a.m. ...	0	0	0	0	0	0	0	2
14, 9 a.m. ...	1	1	0	0	0	1	1	1
15, 10 a.m. ...	0	0	0	0	0	1	1	1
16, 10 a.m. ...	0	0	0	0	0	0	0	0
22, 10 a.m. ...	0	0	0	0	0	0	0	...
23, 10 a.m. ...	0	0	0	0	0	0	0	1
24, 10 a.m. ...	0	0	0	0	0	0	0	0
25, 10 a.m. ...	0	0	0	0	0	0	0	0
26, 10 a.m. ...	2	4	0	0	0	2	4	4
29, 9 a.m. ...	1	1	1	1	1	2	2	5

#### VERIFICATIONS.

##### FORECASTS FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for November, 1889, were made by 1st Lieutenant Richard E. Thompson, 6th Infantry, Signal Officer, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

##### Percentages of forecasts verified, November, 1889.

States.	States.
Maine.....	84.4
New Hampshire.....	77.1
Vermont.....	76.5
Massachusetts.....	79.1
Rhode Island.....	78.9
Connecticut.....	74.5
Eastern New York.....	82.9
Western New York.....	80.8
Eastern Pennsylvania.....	80.6
Western Pennsylvania.....	80.2
New Jersey.....	80.0
Delaware.....	78.5
Maryland.....	78.9
District of Columbia.....	75.9
Virginia.....	84.3
North Carolina.....	84.3
South Carolina.....	86.2
Georgia.....	86.9
Eastern Florida.....	85.0
Western Florida.....	86.7
Alabama.....	77.0
Mississippi.....	81.7
Louisiana.....	90.2
Texas.....	88.4
Arkansas.....	79.4
Tennessee.....	77.3
By elements: Weather.....	85.4
Temperatures.....	74.9
Monthly percentage of weather and temperature combined.....	81.2

\* In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. † The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10. ‡ The forecasts of temperature in districts east of the Rocky Mountains for November, 1889, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day.

##### FORECASTS FOR 48 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for forty-eight and seventy-two hours,

covering the second and third days in advance. Such forecasts are optional with the predicting officer, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 106; temperature, 62. Percentages of verifications: weather, 84.1; temperature, 88.4. Weather and temperature combined, 85.8.

No forecasts for seventy-two hours were made during the month.

#### CAUTIONARY SIGNALS FOR NOVEMBER, 1889.

Statement showing percentages of justifications of wind signals for the month of November, 1889:

**Wind signals.**—(Ordered by 1st Lieutenant R. E. Thompson.) Total number of signals ordered, one hundred and twenty-two; justified as to velocity, wholly, eighty-two, partly, four; justified as to direction, one hundred and twenty. Of the signals ordered, ninety-nine were cautionary, of which sixty-three were wholly, and one partly, justified; and twenty-three were storm signals, of which nineteen were wholly, and three partly, justified. Fifty-six signals were ordered for easterly winds, of which fifty-four were justified, and sixty-six were ordered for westerly winds, all of which were justified. Percentage of justifications, 70.1.

**Cold-wave signals.**—(Ordered by Assistant Professor T. Russell.) Total number of signals ordered, one hundred and sixty-one, of which fifty-one were justified.

**Percentages of local verifications of weather and temperature signals reported by directors of the various State Weather Services for November, 1889.**

States.	Weather.	Temper.	States.	Weather.	Temper.
Illinois.....	80.4	75.4	Nebraska.....	84.2	87.7
Indiana.....	81.0	83.0	New Jersey.....	86.7	96.0
Kansas.....	81.2	85.8	New York.....	87.3	84.8
Michigan.....	85.0	84.4	Ohio.....	84.0	83.0
Minnesota.....	77.0	82.0	Pennsylvania.....	89.0	86.9
Missouri.....	86.0	85.0	South Carolina.....	83.0	84.7

## STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for November, 1889, of the directors of the various state weather services:

## ALABAMA.

The weather was generally mild and pleasant, but the last week of the month was so cold that the average temperature was reduced to  $2^{\circ} 1$  below the normal. The average precipitation was 2.19 above the normal. The rain was very uniformly distributed over the state.

## SUMMARY.

**Temperature.**—Monthly mean, 52.1; highest monthly mean, 70, at Eufaula; lowest monthly mean, 37, at Fayette and Valley Head; maximum, 82, at Butler, 1st; minimum, 20, at Elkmont, 30th; range for state, 62; greatest local monthly range, 58, at Butler; least local monthly range, 45, at Elkmont.

**Precipitation.**—Average for the state, 6.02; greatest, 8.57, at Evergreen; least, 2.75, at Gadsden.—P. H. Mell, *Signal Corps, Auburn, director.*

## ARKANSAS.

## SUMMARY.

**Temperature.**—Monthly mean for the state, 48.1; highest monthly mean, 63.5, at Malvern; lowest monthly mean, 41.7, at Winslow; maximum, 86, at Devall's Bluff, 15th; minimum, 17, at Winslow, 29th; range for state, 69; greatest local monthly range, 66, at Devall's Bluff; least local monthly range, 38, at Dayton.

**Precipitation.**—Monthly average for the state, 7.55; greatest monthly, 16.25, at Heber; least monthly, 0.41, at Prescott.—M. F. Locke, *Commissioner of Agriculture, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.*

## COLORADO.

## SUMMARY.

**Temperature.**—The mean for the state was 29.1, a deficiency of 3.9, as compared with previous November records. The most marked departures were: Monte Vista, 11, Rocky Ford, 10, and Aspen, 9 below the normal; Climax, Fort Lewis, and Logmont are the only stations reporting the temperature in excess of the normal. The highest monthly mean was 39.6, at Lamar, and the lowest, 17.9, at Monte Vista; maximum temperature, 80, at Breckenridge, 10th; minimum, -16, at Breckenridge and Monte Vista, 12th; greatest monthly range, 96, at Breckenridge; least monthly range, 45, at Georgetown.

**Precipitation.**—The average for the state was 0.96, which is over fifty per cent. above the normal; greatest monthly, 4.70, at Breckenridge; least monthly, 0.00, at Amherst, and, trace, at Vilas. The following heavy snowfalls were reported: Breckenridge, 47; Gunnison, 36; and Leadville, 30.—Prof. F. H. Loud, *Colorado Springs, director; W. S. Miller, Corporal, Signal Corps, assistant.*

## ILLINOIS.

## SUMMARY.

**Temperature.**—Monthly mean for the state, 38; maximum, 72, at Flora and Golconda, 1st; minimum, -1, at Woodstock, 29th; mean of maximum temperatures for the state, 60.6; mean of minimum temperatures for the state, 8.0; monthly mean of the maximum and minimum temperatures, 39.0.

**Precipitation.**—Monthly average for the state, 3.80.

**Wind.**—Prevailing direction, northwest.—John Craig, *Sergeant, Signal Corps, Springfield, in charge.*

## INDIANA.

The weather during the month although cloudy was moderately warm and the mean temperature nearly normal.

## SUMMARY.

**Temperature.**—Monthly mean, 40; highest monthly mean, 46.5, at Jeffersonville; lowest monthly mean, 32.9, at Mauzy; maximum, 76, at Vevay, 1st; minimum, zero, at Mauzy, 30th; range for state, 53; greatest local monthly range, 66, at Vevay; least local monthly range, 41, at Columbia City.

**Precipitation.**—Average for the state, 4.90; greatest, 9.25, at Marengo; least, 2.50, at Marion.

**Wind.**—Prevailing direction, west.—Prof. H. A. Huston, *La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.*

## IOWA WEATHER CROP BULLETIN SERVICE.

## SUMMARY.

**Temperature.**—Monthly mean, 33.1; highest monthly mean, 39, at Washington; lowest monthly mean, 27.6, at Carroll; maximum, 68, at Blakeville, 9th and 20th; minimum, -3, at Bancroft, 28th; average maximum, 58; average minimum, 3.3; greatest local monthly range, 68, at Blakeville; least local monthly range, 50, at Keokuk, Carroll, McCausland, and Larrabee; monthly range for the state, 71; average monthly range, 54.8.

**Precipitation.**—Average for the state, 1.37; greatest, 2.61, at Blakeville; least, 0.62, at Independence.

**Wind.**—Prevailing direction, northwest.—G. M. Chappel, *Sergeant, Signal Corps, Des Moines, in charge, Iowa Weather Crop Bulletin Service.*

## KANSAS.

## SUMMARY.

**Temperature.**—The temperature is deficient over the entire state, the deficiency being greatest in the southeastern counties, where it amounts to 4. It gradually diminishes toward the west, being 2 in Ford. Monthly mean for the state, 37.5; highest monthly mean, 42.3, at Lakin; lowest monthly mean, 31.0, at Allison; maximum, 76, at Sedan, 23d; minimum, 4, at McAllaster, 16th; range for state, 72; greatest local monthly range, 62, at Lebo; least local monthly range, 42, at Weskan; greatest daily range, 43.7, at Lebo, 18th; least daily range, 2.9, at Toronto, 26th.

**Precipitation.**—The precipitation is normal in the extreme southeastern counties, slightly deficient in the northern part of Douglas and thence through the northeastern counties, but it is about normal in the extreme western. Average for the state, 1.43; greatest monthly, 3.75, at McPherson; least monthly, 0.10, at Grinnell.

**Wind.**—Prevailing direction, northwest.—Prof. J. T. Lovewell, *Topeka, director; T. B. Jennings, Sergeant, Signal Corps, assistant.*

## KENTUCKY.

The month was characterized by an excess of cloudy and rainy weather.

## SUMMARY.

**Temperature.**—The average temperature for the state for November, as deduced from the tri-daily observations, was 43.1; from the mean of the average maximum and average minimum temperatures, 43.3. These figures indicate a departure of about 2 below the normal for the month. The highest temperature recorded during the month was 78, at Franklin, on the 1st, and the lowest, 10, at Owenton, on the 30th. The average monthly range of temperature was 55.3; the greatest, 62, at Owenton, and the least, 43, at Murray. The highest temperatures were, without exception, recorded on the 1st, and the lowest, on the 29th and 30th.

**Precipitation.**—The average precipitation for the month was 6.04, which is about 2.00 in excess of the normal amount. This reduced somewhat the existing yearly deficiency, which, however, on the 30th, was still 12.30 at Louisville. The greatest amount of precipitation reported during the month was 7.43, at Princeton, and the least, 4.03, at Ashland. Snows were quite general throughout the state on the 18th and 30th. The greatest monthly depth reported was 6.5.

**Wind.**—Prevailing direction, west.—Dr. E. A. Grant, *Louisville, director; Frank Burke, Sergeant, Signal Corps, assistant.*

## LOUISIANA.

A normal temperature is obtained for the southern section. In the northern section there was a deficiency of 2.0 for the month. The average rainfall for the state was deficient by 0.10, but the deficiency in the southern section was 0.75. In the northern section there was an excess of nearly 1.00.

## SUMMARY.

**Temperature.**—Monthly mean, 54.3; highest monthly mean, 58.7, at New Orleans; lowest monthly mean, 51.2, at Farmerville; maximum, 89, at New Iberia, 1st; minimum, 24, at Coushatta and Clinton, 29th, and at Natchitoches and Amite, 29th and 30th; range for the state, 65; greatest local monthly range, 60, at Vidalia, Amite, Plaquemine, and Cameron; least, 39, at Shell Beach; mean daily range, 23.8.

**Precipitation.**—Average for the state, 4.57; for the northern section, 6.01; southern section, 3.49; greatest local monthly, 9.10, at Shreveport and Columbia; least local monthly, 2.18, at New Orleans; excessive daily rainfalls, 2.57 at Shreveport, on 6-7th, 3.00 at Columbia, on 7th and 12th, and 2.90 at Coushatta, on 6th.

**Wind.**—Prevailing direction, northwest.—R. E. Kerkam, *Sergeant, Signal Corps, New Orleans, in charge.*

## MICHIGAN.

The temperature was above the average in all sections, and there were no decided falls in temperature until the afternoon of the 28th, and the temperature fell to below zero in the northern portion of the state by the 30th.

## SUMMARY.

**Temperature.**—The mean temperature for the month, 36.4, is 0.2 above the normal of fourteen years. The temperature was above the normal on thirteen days, normal on four, and below normal on thirteen. The highest daily mean temperature, 47, occurred on the 2d, when the temperature was 4 above the normal, and the lowest, 21, on the 30th, when it was 6 below the normal. The highest daily mean temperature in the past fourteen Novembers, 58, occurred on the 1st, 1876, and the lowest, 5, on the 21st, 1880. The highest monthly mean temperature, 38.3, occurred in 1878 and 1883, and the lowest, 27.5, in 1880. The maximum temperature for the month, 65, occurred at Gladwin on the 2d, and the lowest, -4, on the 30th, at Chase.

**Precipitation.**—The average for the month, 2.87, is 0.06 below the average of fourteen years. The precipitation was below the average in the Upper Peninsula and the central section, 0.77 in the former and 0.30 in the latter, and was above the average 0.01 in the northern section and 0.34 in the

southern section. The greatest departure from the average occurred in the southwest portion of the state, where the precipitation ranged from 1.00 to 3.00 above the average. The precipitation in the Upper Peninsula was below 2.00, except at Lathrop and Saint Ignace. The largest amount recorded, 5.60, occurred at Buchanan, and the least, 0.52, at Crystal Falls.

*Wind.*—Prevailing direction, southwest.—*N. B. Conger, Sergeant, Signal Corps, Lansing, director.*

#### MINNESOTA.

The average temperature for the state for November, 27.3, nearly coincides with the normal, the departure being only a fraction of a degree. The temperature was 4.5 in excess in the extreme northwest, nearly normal at Moorhead, 2 in excess at Duluth, and in the southern half of the state there was a deficiency of from 1 to 2.

The precipitation averaged 1.10, this is a deficiency of about 15 per cent. The counties in the northwest and southeast received more than the usual quantity, while the deposit was deficient in all other districts, notably so at Moorhead, where the greatest single measurement was only 0.04, and the total for the month less than 0.2.

#### SUMMARY.

*Temperature.*—Highest monthly mean, 32.0, at La Crosse, Wis.; lowest monthly mean, 23.0, at Pokegama Falls; maximum, 64, at Montevideo, 6th; minimum, -25, at Pokegama Falls, 29th; range for state, 89; greatest local monthly range, 75, at Pokegama Falls; least local monthly range, 52, at La Crosse, Wis., and Farmington; greatest daily range, 44, at Montevideo, 8th; least daily range, 2.7, at Owatonna, 14th.

*Precipitation.*—Greatest, 2.40, at Rolling Green; least, 0.09, at Morris.

*Wind.*—Prevailing direction, northwest.—*John Healy, Private, Signal Corps, Saint Paul, in charge.*

#### MISSISSIPPI.

#### SUMMARY.

*Temperature.*—The monthly mean temperature for the state, 51, is nearly 3 below the normal; highest monthly mean, 56.5, at Pearlington and Logtown; lowest monthly mean, 44.9, at Macon; maximum, 89, at Macon and Aberdeen, 1st; minimum, 18, at Louisville, 30th; range for the state, 71; greatest local monthly range, 68, at Port Gibson; least local monthly range, 42, at Pearlington.

*Precipitation.*—The monthly average for the state, 3.79, is 0.85 below the normal; greatest monthly, 6.78, at Mobile, Ala.; least monthly, 0.05, at Hazlehurst.

*Wind.*—The wind was very variable, and its prevailing directions at stations are variously reported as being from the southeast at the southern and from the north or northwest at stations farther north.—*R. B. Fulton, Signal Corps, University, director.*

#### MISSOURI.

#### SUMMARY.

*Temperature.*—The highest average monthly temperature was 44.2 and 42, at Cairo, Ill., and Protom, respectively; the lowest means were reported from the northwest, 33.3, at Harrisonville, and 34.1, at Oregon; the lowest temperatures of the month were 8, at Keokuk, Iowa; 9, at Sedalia; 9.8, at Glasgow, and 10, at Kansas City; at Cairo, Ill., and Protom the lowest temperature was 20; at all other stations the minimum for the month was below 20; the highest temperature reported was 76, at Protom.

*Precipitation.*—The rainfall in the state was less than 1.00 in the extreme northwest, increasing to 5.50 in the southeastern part. This is a normal distribution for November rainfall, although the amount is everywhere in excess of the normal amount.—*Prof. Francis E. Nipher, Saint Louis, director.*

#### METEOROLOGICAL REPORT OF THE MISSOURI STATE BOARD OF AGRICULTURE.

#### SUMMARY.

*Temperature.*—Monthly mean, 40.1; highest monthly mean, 44.2, at Cairo, Ill.; lowest monthly mean, 36.3, at Harris; maximum, 76, at Protom, 23d; minimum, 6, at Frankford, 29th; range for the state, 70; greatest local monthly range, 63, at Sedalia; least local monthly range, 34, at Marshfield.

*Precipitation.*—Average for the state, 3.43; the greatest was 6.25, at Hermann, and the least, 1.36, at Warrensburgh. The greatest amount of unmelted snow during the month was 6.0 inches, at Ironton.

*Wind.*—Prevailing direction, northwest.—*Levi Chubbuck, Secretary of State Board of Agriculture, Columbia, director; A. L. McRae, Sergeant, Signal Corps, assistant.*

#### NEBRASKA.

The month of November has presented no remarkable feature, unless it be the early occurrence of a considerable fall of snow. The precipitation and cloudiness have been a little above the normal, and the temperature was two or three degrees below.

#### SUMMARY.

*Temperature.*—The mean for the month for the southeastern portion of the state, 33.5, is 2.5 below the normal; maximum, 75, at Alliance; minimum, -12, at Fort Niobrara, 12th.

*Precipitation.*—Over the western part of the state the precipitation has not amounted to 1.00; over an irregular area in the eastern part it has exceeded 1.00, with three limited localities where over 2.00 fell.—*Prof. Goodwin D. Sweeney, Crete, director; G. A. Loveland, Corporal, Signal Corps, assistant.*

#### NEVADA.

#### SUMMARY.

*Temperature.*—The temperature has been nearly normal throughout the state, the average from 29 stations being 39.5, which is 0.8 below the normal. The highest temperature reported was 80.8, at El Dorado Canyon, on the 23d, and the lowest reported was 4, at Elko, on the 4th, which gives 76.8 as the extreme range for the state.

*Precipitation.*—Precipitation was general throughout the state from the 18th to the end of the month, being heaviest in Washoe, Storey, Ormsby, and Douglas counties, and the northern portion of Esmeralda county. The greatest amount reported from any one station was 5.45, at Genoa, where 4.73 fell on the 18th, 19th, 20th, and 22d. Following Genoa came Lewers' Ranch, with 5.04, and Verdi, with 3.48. At stations in high altitudes snow fell in amounts from 0.5 to 9, which latter amount is reported from Tuscarora. The copious rains have started vegetation in many localities, giving the stockmen great relief. At Ferguson's Ranch, Churchill Co., alfalfa is reported in excellent condition.

*Wind.*—Prevailing direction, south.—*Prof. Chas. W. Friend, Carson City, director; H. E. Wilkinson, Corporal, Signal Corps, assistant.*

#### NEW ENGLAND METEOROLOGICAL SOCIETY.

The average temperature was about 8 above the normal, and there was an excess of about 2.50 over the normal amount of precipitation.

#### SUMMARY.

*Temperature.*—Monthly mean, 41.1; highest monthly mean, 46.9, at Block Island; lowest monthly mean, 28.4, at Weathersfield Centre; maximum, 68, at Lunenburg, 3d; minimum, -3, at Weathersfield Centre, 30th; range for New England, 71; greatest local monthly range, 68, at Lunenburg; least local monthly range, 32, at Nantucket; greatest daily range, 44, at Weathersfield Centre, 14th; least daily range, 0.7, at Woonsocket, 27th. The average temperature for twenty-five stations, having records for more than ten years, is 38.7; the average for November, 1889, is 41.9; departure, +3.2.

*Precipitation.*—Average for New England, 6.12; greatest, 10.08, at Shelton; least, 2.46, at Nantucket. The average precipitation for November, for thirty-four stations having records for more than ten years, is 4.15; the average for November, 1889, is 6.20; departure +2.05.

*Wind.*—Prevailing direction, west.—*Prof. William H. Niles, Boston Mass., president; Prof. Winslow Upton, Providence, R. I., secretary; L. G. Schultz, Sergeant, Signal Corps, assistant.*

#### NEW JERSEY.

#### SUMMARY.

*Temperature.*—The mean temperature for the month, 45.7, is 3.6 above the normal, and 0.1 below the average for the corresponding month of 1888; highest monthly mean, 49.6, at Cape May C. H. and Woodbury; lowest monthly mean, 40.5, at Hanover; maximum, 74, at Tenafly, 17th; range for state, 61; greatest local monthly range, 61, at Tenafly; least local monthly range, 24, at Billingsport and Trenton; greatest daily range, 38, at Cape May C. H., 15th; least daily range, 2, at Moorestown, New Brunswick, Trenton, and Union, 8th, and at Lambertville, 21st.

*Precipitation.*—The average for the state, 8.48, is 5.06 above the average for the month; greatest, 11.45, at Belleville; least, 4.70, at Ocean City.

*Wind.*—Prevailing direction, northwest.—*E. W. McGann, Sergeant, Signal Corps, New Brunswick, in charge.*

#### NEW YORK.

#### SUMMARY.

*Temperature.*—The highest temperature reported was 70, at Savona, 2d; and the lowest was 5, at Number Four, 16th. The mean temperature for the state was 40, the 2d being the warmest, and the 16th the coldest day. The greatest local monthly range of temperature was 48.5, at Lyons; and the least was 33.2, at Brooklyn. The temperature was much above the average.

*Precipitation.*—The average precipitation for the state was 5.20, or much above the normal amount. The greatest monthly rainfall was 11.66, at White Plains; and the least was 2.21, at Saranac Lake. The average number of days on which the precipitation was 0.01, or more, of rain or snow was 14.5. Snow was reported from 24 stations between the 26th and 30th; the fall being quite generally distributed over the state. The greatest amount, 13.2, fell at Canton on the 27th and 28th.

*Wind.*—Prevailing direction, southwest.—*Prof. E. A. Fuertes, Ithaca, director; I. W. Brewer, Private, Signal Corps, assistant.*

#### NORTH CAROLINA.

#### SUMMARY.

*Temperature.*—The monthly mean temperature for the state, 52.3, is 1.7 above the normal of the last eight years; maximum, 81, at Chapel Hill, 1st; minimum, 15, at Asheville, 29th; range for the state, 66; highest monthly mean, 58.4, at Southern Pines; lowest monthly mean, 44.2, at Marion, Va.; greatest monthly range, 61, at Mount Pleasant; least monthly range, 44, at Hatteras and Mount Airy.

*Precipitation.*—The average for the state, 4.14, is 0.05 above the normal. The rainfall was about 1.00 in excess in the western portion of the state, and slightly deficient in the central and eastern portions. The greatest monthly rainfall was 6.58, at Knoxville, Tenn., and the least monthly, 2.18, at Southport. The heaviest rainfall for November that has occurred in the state during the last sixteen years was 13.02, at Hatteras, in 1884.

**Wind.**—Prevailing direction, southwest; average direction, as deduced from many years observations, northeast.—*Dr. Herbert B. Battle, Raleigh, director; C. F. von Herrmann, Sergeant, Signal Corps, assistant.*

#### NORTH AND SOUTH DAKOTA.

The monthly mean temperature for the states is about normal, or possibly 1 below, and the average temperature is about 0.31 below the normal.

##### SUMMARY.

**Temperature.**—Monthly mean, 27.0; highest monthly mean, 33, at Spearfish and Rapid City; lowest monthly mean, 20, at Napoleon; maximum, 75, at Wapeton, 9th; minimum, —28, at Fort Buford, 28th; range for the states, 103; greatest local monthly range, 89, at Fort Buford; least local monthly range, 55, at Canton.

**Precipitation.**—Average for the states, 0.33; greatest monthly, 1.08, at Canton; least monthly, trace, at Clark and Woonsocket.—*S. W. Glenn, Sergeant, Signal Corps, Huron, in charge.*

#### OHIO.

##### SUMMARY.

The mean temperature of the northern section was 40.5, of the middle section, 40.3, and of the state, 41.0. These means are 0.8, 0.3, and 0.8 above the averages for the past eight years. The mean temperature of the southern section, 42.4, was 0.1 below the eight year average. The maximum temperature reported was 77.0, at Hanging Rock, 1st, and the minimum, 8.6, at Wauseon, 30th. The mean daily range of temperature was 15.1. The greatest daily range was 38.5, at Portsmouth, 12th, and the smallest, 2.0, at Cincinnati, on the 22d.

**Precipitation.**—The mean rainfall in the northern section, 2.81, was 0.03 below the eight year average. The mean in the middle section was 4.38, and in the southern section, 4.85. These means are 1.14 and 1.64 above the averages for these sections for November. The mean for the state, 4.02, is 0.92 above the average. The greatest monthly rainfall reported was 8.00 at West Milton, and the smallest, 1.71, at Sandusky and Vienna.

**Wind.**—Prevailing direction, west.—*Prof. B. F. Thomas, Columbus, director; Lieut. Charles E. Kilbourne, secretary; C. M. Strong, Corporal, Signal Corps, assistant.*

#### OREGON.

##### SUMMARY.

**Temperature.**—The monthly average for the state, 42.7, is 2.1 above the normal. The average excess along the immediate coast is 2.8; in the interior valleys, 2.3; and in the eastern portion of the state, 1.2. The mean temperature along the coast was 50; in the interior valleys, 46; and in eastern Oregon, 39; highest monthly mean, 50.8, at Bandon; lowest monthly mean, 33, at Joseph and North Powder; maximum, 74, at Bandon; minimum, 5, at North Powder; range for state, 69.

**Precipitation.**—The precipitation was below the average in all sections of the state, except in Douglas and Coos counties, and undoubtedly in all southwestern counties. The deficiency ranged from 5.00, at Fort Canby, to 0.35, at Mount Angel. Along the coast from 4.00 to 7.00 fell; in the interior valleys from 3.00 to 5.00; and in eastern Oregon about 0.75. The average for the state was 3.00.

**Wind.**—Prevailing direction, southwest.—*Hon. H. E. Hayes, Master State Grange, Portland, director; B. S. Pague, Sergeant, Signal Corps, assistant.*

#### PENNSYLVANIA.

##### SUMMARY.

**Temperature.**—The mean temperature of sixty-six stations was 41.9, which is from 2 to 3 above the normal, and the same as that of November, 1888. The means of the daily maximum and minimum, 48.8 and 34.7, give a mean temperature of 41.8, and an average daily range of 14.1. The highest temperatures reported during the month were Greensburg, 73; Annville and Centre

Valley, 71. The lowest were Dyberry, Somerset, and Coudersport, 10; Lock Haven, Wellsborough, and Columbus, 12.

**Precipitation.**—The average precipitation for the state was 6.72, which is double the usual quantity for November. As there was only a slight excess in the northwestern portion of the state, this ratio was greater in other parts. The greatest totals were Girardville, 10.16; Meyerstown, 9.90; Westchester, 9.91; Eagle's Mere, 9.27; Pottstown, 9.15; and Lancaster, 9.02. Excessive rains occurred on the 18th and 19th, which caused heavy freshets along the Susquehanna, that carried away railroad bridges and rafts of lumber.

**Wind.**—Prevailing direction, west.—*Under direction of the Franklin Institute, Philadelphia; T. F. Townsend, Sergeant, Signal Corps, assistant.*

#### SOUTH CAROLINA.

The monthly mean temperature for the state is over 2.0 higher than the mean of November in either 1887 or 1888. The average monthly rainfall for the state was over one inch in excess of that for November in either of the two preceding years.

##### SUMMARY.

**Temperature.**—Monthly mean temperature, 54.8; maximum, 84, at Saint Matthew's, 1st; minimum, 18, at Spartanburgh, 30th; range for state, 66.

**Precipitation.**—Monthly average for the state, 3.84; greatest monthly, 7.28, at Charleston; least monthly, 0.66, at Chester.

**Wind.**—Prevailing direction, west.—*Hon. A. P. Butler, Columbia, director; J. W. Cronk, Sergeant, Signal Corps, assistant.*

#### TENNESSEE.

The month of November was in many respects an abnormal one in its meteorological features. While the temperature was about the normal, the rainfall was excessive and the percentage of cloudiness was much above the normal. The snowfall was much in excess of the usual amount for this month.

##### SUMMARY.

**Temperature.**—The mean temperature was 47.3, the normal for the past seven years. The highest local monthly mean was 51.9, at Cog Hill, and the lowest was 44.2, at Rugby and Nunnelly. The highest temperature observed was 80, on the 1st, at Savannah; and the lowest was 19, on the 30th, at Rugby, the first and last days of the month showing the extremes of temperature. The maximum temperature was, with two or three exceptions, recorded on the 1st, and the minimum, with a few exceptions, on the 29th. The daily ranges of temperature were generally less than usual for November.

**Precipitation.**—The average precipitation was 6.52, being the greatest November average during the past seven years, the next greatest being 6.39, in 1886. This amount is 2.50 above the November mean for the past seven years. Of this amount the eastern division received an average of about 5.75, the middle and western divisions each a little more than 6.75. There were fourteen days of general rains, including snowfall. The greatest monthly rainfall, 9.83, was reported at Trenton. This was the greatest local amount reported in November during the past seven years, the next greatest being 8.89, at Memphis, in 1886. The greatest local daily rainfall was 3.07, reported at Knoxville on the 8th; the next greatest was 2.83, at Trenton, on the 18th.

**Wind.**—Prevailing directions, north and west.—*J. D. Plunket, M. D., Nashville, director; H. C. Bate, Sergeant, Signal Corps, assistant.*

#### TEXAS.

##### SUMMARY.

**Temperature.**—The mean temperature over the state ranged from 36, at Fort Elliott, to 65, at Brownsville; the highest temperature was 85, at Brownsville, on the 21st; at Cuero, on the 24th; and at College Station, on the 25th; the lowest was 17, at Fort Elliott, on the 29th.

**Precipitation.**—The precipitation during the month was heaviest over the eastern portion of the state, where, at Tyler, it exceeded 10.00, and decreased with marked regularity westward to the one hundred and second meridian, west of which the amount did not exceed 1.00.—*D. D. Bryan, Galveston, director; I. M. Cline, Sergeant, Signal Corps, assistant.*

#### NOTES AND EXTRACTS.

##### EQUINOCTIAL STORMS.

[Prepared by Assistant Professor H. A. HAZEN, by order of the Chief Signal Officer, to meet the numerous demands made upon this office for information relative to equinoctial storms.]

There have come to the Signal Office, from time to time, inquiries regarding the existence of storms about the 21st of March and 21st of September of each year. There also seems to be a fairly well-grounded belief in the minds of many intelligent persons that the so-called equinoctial storms, or storms influenced, if not generated, by the seeming passage of the sun across the equator, have a real existence. Others have gone still farther and have considered that the equinoctial points of the planets have an important bearing upon terrestrial weather. When it is considered that the equinoxes are wholly imaginary points in the sky, or the intersections of two imaginary lines, the equator and the path of the sun, we must conclude at once that the apparent presence of the sun at either of these points can have absolutely no effect upon

our weather. It might be thought that somehow the lengthening day at the spring equinox and the corresponding shortening one in the fall might affect the weather. However, not only are these directly contrary to each other and therefore incapable of producing like effects, but also the increase or diminution is only two and one-half minutes daily, and the action is a continuous one for weeks before and after the equinox, so that on all accounts it is impossible for us to consider that there can be any effect whatever from this cause.

There still remains this consideration, that possibly there is a recurring storm period about the 21st of March and 21st of September which may be entirely independent of the equinoxes. This question, though entirely different from the previous one, has been carefully investigated by Prof. R. H. Scott, of London. He collected all the severe storms that passed over Great Britain for fourteen years, and found that out of forty-five storms in March not one occurred on the 21st, and out of eighteen storms in September, only one occurred on the 21st.

Taking intervals of three days and five days he found—

Months.	Three days.			Five days.		
	17-19	20-22	23-25	14-18	19-23	24-28
March	5	3	2	8	5	4
September	2	2	2	3	2	6
Total	6	5	4	11	7	10

These figures show very plainly, especially in the five day intervals, that storms are much more frequent just before and after the equinoxes than near them. This whole discussion will be found in Quarterly Journal, Royal Meteorological Society of England, 1884, page 236.

It seemed advisable to make a rather thorough search in the records of this office for the past sixteen years in order to establish the occurrence or non-occurrence of such storms in the United States. It was thought at the outset that the elements most likely to give the best results were (1) wind, (2) pressure, (3) precipitation, (4) storms.

1st. *Wind*.—Four stations were selected in the United States, Omaha, Saint Louis, Pittsburgh, and Washington, in an east and west direction and five stations, Marquette, Milwaukee, Louisville, Nashville, and Vicksburg, in a north and south direction. The daily wind movements from the 16th-26th of each month, at these stations, were worked up separately and in two groups. The first group included the years 1873-'80, and the second the years 1881-'88. The curves for the four stations and the five stations agreed very remarkably, and showed that practically the oscillations could be considered as applied to the whole country from the Rocky Mountains to the Atlantic. The two periods, 1873-'80 and 1881-'88, however, showed almost directly opposite phases each to each. Afterward, at the suggestion of the Chief Signal Officer, all the winds at 7 a. m., above fourteen miles per hour, for the whole country from the Atlantic to the Pacific, were counted up. The number of observations each day in this last reckoning was not far from 2,000, or 22,000 for the eleven days. As will be seen, this curve, especially in March, agrees almost exactly with the previous curve for the total wind movement at nine stations, and we may conclude that the result would not be materially altered if the number of stations were indefinitely increased.

2d. *Pressure*.—In the same manner the observations of pressure were worked up for the four stations above for the whole period, 1873-'88.

3d. *Rainfall*.—The total rainfall for the days, 16-26 of March and September, was also computed for all the stations. This gives nearly 2,000 observations of rainfall for each day, or 22,000 for the eleven days. The curves for the periods, 1873-'80 and 1881-'88, unlike those for wind, were almost identical in both months.

4th. *Storms*.—All the storms whose centres could be identified upon the Signal Service maps were counted for the same days and periods, and in taking the sum for the whole period, 1873-'88, the 2d order of means was computed, thus serving to smooth out the irregularities. The curves for the two periods were nearly identical, though not as regular in September as in March.

The following is a brief description of the curves (see chart v):

- (A) Daily movement of wind at four stations, 1873-'80, March.
- (B) Daily movement of wind at five stations, 1873-'80, March.
- (C) Daily movement of wind at four stations, 1881-'88, March.
- (D) Daily movement of wind at five stations, 1881-'88, March.
- (E) Daily movement of wind at nine stations, 1873-'88, March.
- (F) Total number of times wind was above fourteen miles per hour, 1873-1889, March.
- (G) Daily movement of wind at nine stations, 1873-'80, September.
- (H) Daily movement of wind at nine stations, 1881-'88, September.
- (I) Daily movement of wind at nine stations, 1873-'88, September.
- (K) Total number of times wind was above fourteen miles per hour, 1873-1889, September.

- (L) Oscillations in pressure, four stations, 1873-'88, March.
- (M) Oscillations in pressure, four stations, 1873-'88, September.
- (N) Total rainfall, all stations in United States, 1874-'81, March.
- (O) Total rainfall, all stations in United States, 1882-'89, March.
- (P) Total rainfall, all stations in United States, 1874-'88, March.
- (Q) Total rainfall, all stations in United States, 1874-'89, September.
- (R) Number of storm centres each day of March, 1873-'80.
- (S) Number of storm centres each day of March, 1881-'88.
- (T) Number of storm centres each day of March, 1873-'88.
- (U) Number of storm centres each day of September, 1873-'88.

A study of these curves shows the following:

1st. (A) and (B): that the wind in general is very much higher before and after the March equinox than at it.

2d. (C) and (D): that the wind is lower before and after the March equinox than on that date.

3d. (E) and (F): that while the wind is a little lower before and after, yet there are two dates on which it is almost as high as at the March equinox.

4th. (G) (H) (I) and (K): that during the September equinox there is a tendency to less wind.

5th. (L) and (M): that the pressure is either rising or at a maximum during the equinoxes.

6th. (N) (O) and (P): that the precipitation reaches a maximum on March

20th, and has a rapid diminution from that date. Also, curve (N) has two maximum dates, the 16th and 20th.

7th. (Q): that at the September equinox there is nearly a minimum amount of precipitation.

8th. (R) (S) (T): that there is a maximum number of storms on March 8th, and a secondary maximum on March 21st.

9th. (U): that a maximum occurs on September 9th and there is almost a minimum for the whole month on September 21st.

In general, the only curves which indicate a preponderance of storm action during the March equinox are (C) and (D), and these are offset by (A) and (B), which are of the same nature but directly opposite in phases. All the March curves except (A) and (B) show a tendency to increasing storm action on the 20th and 21st, though in most cases there is an equal increase earlier in the month.

All the September curves show a tendency to diminished storm action at the time of the equinox. The conclusion is inevitable, that the observations do not show a preponderance of storm action during the equinoxes.

*Meteorological record of Army post surgeons, voluntary, and other co-operating observers, November, 1889.*

Stations.	Temperature (Fahrenheit.)			Precip'n.	Stations.	Temperature (Fahrenheit.)			Precip'n.
	Max	Min	Mean			Max	Min	Mean	
Alabama.	0	0	0	Ins.	Arkansas—Cont'd.	0	0	0	Ins.
Bermuda *†.	76	22	54.3	6.20	El Dorado †.	71	21	46.2	7.48
Butler.	52	24	53.5	5.74	Forrest City †.	75	24	50.1	6.29
Citronelle.	.....	.....	50.03	.....	Fulton †.	68	18	46.5	6.25
Columbiana †.	75	20	51.6	6.33	Heber.	.....	.....	.....	5.85
Decatur (1) †.	.....	.....	4.15	.....	Helema (1) †.	76	22	48.8	5.85
Decatur (2) †.	76	23	49.4	4.88	Hot Springs.	72	23	50.9	5.83
Double Springs.	72*	22	50.7	5.30	Lead Hill.	76	20	44.1	5.10
Elkmont †.	72	27	48.0	7.90	Little Rock B'ks.	73	22	47.9	11.26
Eufaula.	80	30	50.2	7.47	Lonoke.	73	25	50.1	9.60
Evergreen.	76	22	53.4	8.57	Malvern †.	77	32	65.5	12.34
Fayette C. H. †.	75	20	48.0	3.50	Monticello †.	76	26	50.3	8.07
Fort Deposit †.	76	27	54.6	6.26	Newport (1) †.	73	22	46.4	13.30
Gadsden †.	76	23	51.0	2.75	Newport (2) †.	77	21	45.2	7.69
Grenadaborough †.	76	26	53.0	4.13	Oscoda †.	67	19	42.5	1.34
Livingston (1).	76	22	50.8	4.67	Pine Bluff †.	74	28	49.6	6.95
Livingston (2) †.	76	20	52.4	2.38	Prescott †.	72	26	45.5	0.417
Marietta.	76	20	51.6	4.16	Russellville †.	73	24	46.6	11.25
Mt. Vernon B'ks.	80	23	55.2	6.89	Stuttgart †.	73	21	46.8	7.89
Pine Apple†.	76	26	52.9	5.60	Texarkana †.	78	26	51.6	8.03
Selma (2) †.	80	26	56.0	5.80	Washington †.	74	22	48.4	7.68
Tuscumbia (1).	78	25	49.2	4.06	Winslow †.	69	17	41.1	5.84
Tuscumbia (2) †.	80	20	49.6	5.45	British Columbia.	.....	.....	.....	.....
Union Springs.	75	21	52.0	6.83	New Westminster.	60	31	44.5	5.74
Uniontown.	75	24	54.4	6.21	California.	.....	.....	.....	.....
Valley Head †.	72	22	46.4	7.02	Alcade *.	70	40	53.8	1.50
Juneau.	50	22	34.3	8.15	Alcatraz Island.	74	48	57.5	3.45
Killianoo.	51	24	37.1	4.75	Almaden*.	69	42	55.6	2.73
Arizona.	.....	.....	.....	.....	American Hills.	70	38	51.7	9.10
Antelope Valley.	.....	.....	0.13	.....	Ananeim*.	84	45	61.8	0.30
Ash Creek.	.....	.....	0.60	.....	Angel Island.	82	43	58.5	3.49
Ash Springs.	.....	.....	0.15	.....	Antioch *.	80	40	54.6	2.09
Banghart*.	81	20	48.7	.....	Athlone *.	80	39	56.5	2.33
Benson *.	76	31	54.5	0.00	Auburn *.	80	40	54.4	4.35
Bisbee.	.....	.....	0.20	.....	Bakersfield *.	75	41	57.3	0.22
Buckeye.	.....	.....	0.36	.....	Barstow †.	75	27	52.5	0.70
Casa Grande*.	94	48	69.6	0.10	Beaumont.	72	47	57.3	0.67
Cedar Springs.	.....	.....	0.23	.....	Belmont *.	75	38	57.1	.....
Cooley's Spring†.	.....	.....	2.85	.....	Berendo *.	79	40	54.9	3.11
Dragoon.	.....	.....	0.00	.....	Berkeley.	74	43	56.3	2.39
Dos Cabezos.	.....	.....	0.00	.....	Borden.	80	36	56.0	1.69
Flagstaff †.	57	9	35.6	0.50	Boulder Creek*.	78	28	50.2	9.36
Florence †.	84	32	57.7	0.47	Brentwood*.	77	36	66.6	3.44
Fort Apache.	69	16	42.4	0.80	Brighton*.	80	40	59.2	3.60
Fort Bowie.	70	27	49.8	0.00	Byron*.	74	36	55.4	2.86
Fort Huachuca.	75	23	50.2	0.14	Cactus*.	90	54	71.5	?
Fort Lowell.	92	26	56.2	0.19	Caliente *.	68	47	58.3	1.65
Fort McDowell.	84	31	56.2	0.81	Calistoga *.	90	29	54.4	4.10
Fort Mojave.	75	32	55.9	0.85	Castroville*.	72	49	57.5	2.03
Fort Verde.	73	20	47.0	0.05	Centreville *.	80	46	45.4	3.44
Gila Bend*.	74	42	58.7	0.00	Chico *.	75	40	54.7	2.39
Holbrook *.	70	15	39.5	0.50	Cisco *.	57	25	41.0	9.54
Lochiel *.	73	26	47.5	0.00	Colgrove.	.....	.....	.....	1.62
Maricopa*.	80	42	60.2	0.83	Colfax *.	70	38	51.8	9.60
Pantano *.	80	37	56.2	0.00	Colton *.	82	40	58.1	1.26
Peoria.	75	34	55.6	0.47	Corning*.	80	36	55.9	3.26
Sachse's Ranch.	.....	.....	0.00	.....	Crescent City.	.....	.....	.....	7.12
San Carlos.	81	27	51.4	0.50	Davisville *.	77	36	56.5	3.04
Signal †.	77	32	55.8	0.00	Delano *.	72	42	56.7	0.56
Strawberry †.	.....	.....	0.20	.....	Delta *.	75	37	53.5	10.03
Teviston.	.....	.....	0.20	.....	Downey *.	83	45	61.1	1.33
Texas Hill *.	82	37	56.6	0.05	Dunnigan *.	69	45	55.0	3.59
Tip Top †.	.....	.....	0.00	.....	Dunsmuir.	65	35	47.0	11.65
Tomstone.	74	38	51.0	0.00	Edgewood *.	55	23	41.1	2.35
Tucson (1) †.	82	32	56.2	0.32	El Dorado *.	73	40	57.1	6.32
Tucson (2) *.	75	43	55.1	0.42	El Verano *.	80	40	58.2	4.20
Walnut Grove.	.....	.....	1.00	.....	Elmira *.	78	32	55.1	5.79
Walnut Ranch.	.....	.....	0.13	.....	Emigrant Gap *.	60	30	43.7	11.41
Wilcox*.	79	30	55.3	0.02	Esperanza *.	68	40	53.2	3.79
Williams.	54	13	32.3	0.00	Evergreen.	.....	.....	.....	2.40
Winslow †.	72	16	41.2	0.00	Farmington*.	74	36	54.3	3.28
Yuma*.	76	45	61.0	0.00	Felton *.	70	26	54.9	5.68
Arkansas City †.	.....	.....	5.56	.....	Ferndale.	.....	.....	.....	4.43
Camden †.	75	25	48.0	9.18	Ferron *.	89	43	61.2	.....
Conway.	71	26	47.5	13.17	Folsom *.	75	42	57.0	4.18
Dallas.	68	20	48.2	4.12	Fort Bidwell.	60	20	35.9	2.20
Dardanelle.	.....	.....	9.87	.....	Devall's Bluff †.	.....	.....</		

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
California—Cont'd.	0	0	0	In.	California—Cont'd.	0	0	0	In.
Fort Gaston	68	22	46.6	6.24	Templeton	75	32	53.3	1.84
Fort Mason	73	46	52.3	2.64	Towles	75	32	50.7	.....
Fresno	90	40	61.1	1.43	Tracy	69	32	49.3	2.59
Fruto	76	39	58.2	2.92	Traver	75	38	58.9	1.10
Georgetown	70	34	51.6	9.70	Tropico	80	41	59.9	1.00
Gilroy	76	32	54.8	2.98	Truckee	56	18	39.4	3.29
Girard	65	39	50.5	0.80	Tulare	76	42	57.3	0.43
Goshen	73	36	53.3	0.45	Turlock	76	40	56.0	4.39
Grass Valley	.....	.....	.....	.....	Upper Mattole	78	28	54.4	9.14
Hollister	52	34	57.0	2.09	Vacaville (1)	75	41	56.2	4.30
Hydeville	73	30	52.6	4.47	Vacaville (2)	70	43	56.4	4.26
Indio	80	40	61.5	0.01	Valley Springs	65	47	55.2	3.47
Isone	74	31	49.5	5.15	Volcano Springs	97	38	65.7	0.40
Iowa Hill	72	37	49.0	8.49	Walla Walla Creek	61	47	42.6	3.37
Jolon	.....	.....	.....	.....	Westley	74	42	58.3	1.92
Julian	78	35	51.8	0.93	Wheatland	73	37	52.9	3.16
Keene	75	35	53.4	1.30	Whittier	84	49	65.9	1.39
Kingarburgh	73	35	53.9	0.98	Willow (1)	75	33	54.3	1.80
King City	78	31	52.7	2.74	Winters	77	40	56.0	4.58
Knight's Landing	78	42	60.2	3.93	Woodland	78	40	53.3	3.75
La Grange	74	36	54.9	4.59	Canada.	.....	.....	.....	.....
Lathrop	75	36	56.0	2.51	McGill Col. Observatory, Montreal.	55	14	34.3	3.29
Lemoore	87	34	59.7	1.06	Colorado.	58	8	28.5	0.60
Lewis Creek	68	44	55.9	0.73	Agate	58	8	28.5	0.60
Livermore	80	38	53.8	2.95	Amherst	.....	.....	0.00	.....
Livingston	80	40	55.1	3.20	Apishapa	58	8	32.2	2.75
Los Angeles	80	44	59.3	0.85	Aroya	.....	.....	0.50	.....
Los Banos	76	40	55.6	2.43	Aspen	48	5	22.0	.....
Los Gatos (1)	75	38	59.0	4.33	Bennet	62	5	33.9	.....
Los Gatos (2)	.....	.....	.....	Boulder Cañon	.....	.....	.....	.....	
Mammoth Tank	81	38	63.0	0.11	Breckenridge	80	16	27.6	4.70
Martinez	70	40	55.8	2.66	Brush	.....	.....	0.45	.....
Marysville	75	48	59.0	3.73	Byers	55	14	34.6	0.78
Menlo Park	75	38	55.8	2.38	Cahon City	70	5	33.7	0.78
Merced	70	40	55.3	2.80	Elkhorn	.....	.....	0.95	.....
Modesto	74	41	57.0	2.22	Emma	.....	.....	1.97	.....
Mojave	96	38	59.1	0.45	First View	58	14	33.1	0.25
Montague	64	36	46.6	1.60	Fort Collins	61	1	32.1	0.42
Monterey	68	32	54.3	1.62	Fort Crawford	58	9	34.7	0.33
Monterey (Hotel del Monte)	.....	.....	.....	Fort Lewis	55	5	29.6	2.05	
Mount Hamilton	75	44	57.8	.....	Fort Logan	55	1	30.5	0.90
Napa	63	30	48.5	4.46	Fraser	.....	.....	2.22	.....
National City	84	40	61.5	1.08	Fruit	22*	12.6	2.65	.....
Needles	81	37	59.5	.....	Georgetown	60	8	33.9	.....
Newark	76	40	56.8	2.78	Glenwood Springs	52	7	29.0	1.23
Newhall	82	33	56.4	3.36	Greeley	60	10	33.4	0.21
Newman	70	40	51.6	4.27	Gunnison	55	7	20.7	3.60
Niles	81	40	61.2	3.48	Harden	.....	.....	0.30	.....
Norwalk	84	40	59.4	1.47	Hart	.....	.....	1.97	.....
Oakland (1)	80	39	57.0	2.89	Haus	.....	.....	1.97	.....
Oakland (2)	70	35	56.2	2.78	Heggen	.....	.....	1.97	.....
Orland	85	42	59.0	2.20	Hill	.....	.....	1.97	.....
Oroville	77	39	57.2	4.89	Holman	.....	.....	1.97	.....
Pajaro	75	35	56.8	2.67	Horn	.....	.....	1.97	.....
Petaluma	70	36	55.5	4.17	Hudson	.....	.....	1.97	.....
Placerville	71	36	50.4	8.20	Hugh	53	18	33.7	.....
Pomona	81	44	63.7	0.80	Idaho Springs	61	11	32.9	0.48
Porterville	79	38	55.3	0.45	Julesburg	64	1	34.9	0.31
Presidio of San F.	75	42	57.0	3.19	Kit Carson	65	20	34.8	2.50
Puerto	80	39	57.5	0.40	Lamar	64	11	39.6	0.40
Red Bluff	75	42	57.3	2.99	La Porte	.....	.....	0.07	.....
Redding	79	36	54.3	5.07	Las Animas	59	8	29.4	0.11
Riverside	76	36	55.5	2.04	Leadville	53	—	23.3	1.64
Rocklin	77	42	55.6	4.13	Longmont	62	31	31.9	0.40
Rumsey	73	40	54.3	4.13	Loveland	.....	.....	0.33	.....
Sacramento (1)	73	30	47.6	3.49	Magnolia	60	10	20.6	1.30
Sacramento (2)	69	42	54.2	2.47	Salinas (1)	53	10	28.6	0.94
Salinas (2)	67	38	56.3	2.32	Palmer Lake	63	3	31.4	0.78
Salton	84	34	61.9	0.13	Paoli	64	32	31.4	0.68
Sanger Junction	76	40	56.4	1.31	Parachute	.....	.....	1.21	.....
San Ardo	78	37	54.5	2.96	Ranch near Compo	48	4	22.0	1.30
San Diego B'ks	83	45	61.4	0.15	River Bend	66	18	33.9	0.48
San Gabriel	83	44	61.1	0.40	Rocky Ford	60	10	32.6	0.77
San Jose	75	38	56.3	1.73	San Luis Ex. Sta.	52	10	25.0	1.27
San Mateo	71	38	54.9	4.01	Sedgwick	.....	.....	0.05	.....
San Miguel	73	35	52.2	1.60	T. S. Ranch	60	12	34.7	0.69
Santa Ana	84	40	59.5	0.36	Thon	50	2	28.0	0.29
Santa Barbara (1)	78	44	59.6	3.21	Villas	.....	.....	0.07	.....
Santa Barbara (2)	76	42	61.9	2.85	Watkins	48	14	28.3	1.39
Santa Clara	.....	.....	.....	West Cliff	53	0	23.5	1.39	
Santa Margarita	70	29	50.1	3.20	Weston	.....	.....	0.40	.....
Santa Maria	78	34	58.3	1.80	Wigwam	.....	.....	0.40	.....
Santa Monica	72	40	60.5	1.18	Connecticut.	.....	.....	0.01	.....
Santa Paula	81	45	63.0	1.81	Canton	61	16	7.6	.....
Santa Rosa	76	34	55.8	4.35	Clark's Falls	.....	.....	7.47	.....
Selma	70	38	53.9	1.09	Colchester	63	17	42.6	.....
Seven Palms	86	47	60.0	.....	Falls Village	.....	.....	5.88	.....
Shingle Springs	70	38	52.2	7.85	Fort Trumbull	62	17	45.5	6.16
Sims	70	26	46.6	13.32	Hartford (1)	65	16	43.2	8.67
Sisson	59	26	42.0	5.80	Hartford (2)	65	16	43.2	7.82
Sonoma	78	35	56.9	4.36	Lebanon	.....	.....	5.06	.....
Soquel	78	40	59.2	.....	Mansfield	62	14	40.9	5.91
South Side	70	38	52.3	1.20	Middleton	64	17	42.5	7.03
South Vallejo	68	34	52.3	2.15	Mount Carmel	62	19	42.2	10.03
Spadra	82	44	59.1	1.23	Mount Carmel	62	19	42.2	10.03
Steeles	73	38	57.6	3.22	Mount Carmel	62	19	42.2	10.03
Stockton (1)	.....	.....	3.27	Mount Carmel	62	19	42.2	10.03	
Stockton (2)	76	52	62.2	3.29	Mount Carmel	62	19	42.2	10.03
Summit	52	23	36.3	6.80	Mount Carmel	62	19	42.2	10.03
Suisun City	81	32	57.8	3.27	Mount Carmel	62	19	42.2	10.03
Susaviney	57	22	39.9	2.74	Mount Carmel	62	19	42.2	10.03
Tehachapi	75	30	48.0	0.70	Mount Carmel	62	19	42.2	10.03
Tehama	75	44	56.5	3.41	Mount Carmel	62	19	42.2	10.03

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
Connecticut—Cont'd.	0	0	0	In.	Connecticut—Cont'd.	0	0	0	In.
Waterbury	61	16	41.7	8.74	Waterbury	61	16	41.7	8.74
West Simsbury	.....	.....	.....	6.83	West Simsbury	.....	.....	.....	6.83
Delaware.	.....	.....	.....	.....	Delaware.	.....	.....	.....	.....
Kirkwood	.....	.....	.....	.....	Kirkwood	.....	.....	.....	.....
District of Columbia.	.....	.....	.....	.....	District of Columbia.	.....	.....	.....	.....
Kendall Green	6								

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Kansas.	0	0	0	In.	Louisiana.	0	0	0	In.
Allison	60	12	31.0	0.41	Abbeville	33	34	57.5	3.19
Bendena	49	9	34.6	1.13	Alexandria	34	30	55.9	4.84
Brookville	60	11	32.5	0.50	Amite City	34	24	54.8	2.72
Bucklin					Baton Rouge	34	32	54.0	2.80
Buffalo Park	62	14	30.0		Cameron	33	28	56.2	4.36
Bunker Hill	62	12	35.0	1.00	Chataignier	36	32	56.2	3.40
Burr Oak	55	8	32.0		Cheneyville	36	26	59.0	2.60
Carneiro	62	12	30.0		Clinton	33	24	53.0	3.29
Cawker City	64	15	37.3	0.15	Columbia	82	25	53.5	9.10
Collyer	61		39.7	2.50	Coushatta (1)				7.79
Concordia	58	8	34.8	0.82	Coushatta (2)†	83	24	52.0	7.47
Conway	70	12	36.3	2.20	Crowley	78	30	53.9	3.63
Cunningham	71	12	35.1	1.13	Delhi				7.05
Dorrance	64	13			Donaldsonville	84	27	54.3	3.30
Elk Falls	66	20	40.8	1.33	Emilee	84	34	57.2	3.57
Ellis (1)	71	14	35.9	1.00	Farmerville	79	26	51.2	6.05
Ellis (2)†	70	20			Girard				6.75
Ellsworth	70	14			Grand Cane	82	28	53.2	8.10
Emporia	67	12	38.4	1.80	Grand Coteau	83	30	50.2	2.85
Englewood	68	18	35.2	0.68	Hammond	84	26	54.7	4.44
Pt. Leavenworth (1)	66	9	40.0	2.93	Houma	82	30	55.3	3.25
Pt. Leavenworth (2)	60	8	36.6	2.24	Jackson Barracks	85	33	50.2	1.53
Fort Riley	63	11	38.1	1.50	Jeanerette	89	31	60.2	3.40
Fremont	68	10	36.9	2.02	La Fayette (2)†	85	30	56.2	3.64
Globe	67	10	37.4	2.61	Liberty Charles	82	25	51.6	5.50
Gorham	63	15			Lily Hill	82	25	54.0	7.18
Gove City					Luling	84	25	54.7	4.30
Grainfield	65	17			Mandeville	83	30	55.8	3.98
Grenola	72	17	39.6	1.80	Marksville	87*	28	54.9	3.43
Grinnell	66	18			Maurepas	83	28	55.5	3.17
Halstead	68	11	37.9	1.35	Melville	86	29	54.1	1.78
Havensville	68	8	35.5	0.88	Minden	79	28	51.8	4.24
Hays City	70	13			Monroe	74	28	51.8	0.58
Independence	72	14	39.7	1.88	Natchitoches	78	24	50.2	2.44
Junction City					New Iberia	89	32	60.5	1.20
Kanopolis	60	11	39.1	0.45	Plaquemine	85	25	53.1	2.37
Kellogg	69	14	39.3	2.50	Poitevin à la Hache				5.88
Kirwin					Port Eads	84	40	63.3	2.05
La Harpe	16	37.2	1.73		Shell Beach	79	40	57.3	4.80
Lakin	66	19	42.3	2.70	Sugar Ex. station	82	30	57.0	2.79
Lawrence	65	11	38.2	1.56	Thibodeaux				2.28
Lebo	73	12	39.4	2.73	Trinity	83	26	53.0	3.60
Lincoln	60	14	36.3		Vidalia	88	26	54.6	3.36
Lisbon	64	10	35.0	0.40	Maine.				
Manhattan (1)†					Bar Harbor	60	18	41.6	6.25
Manhattan (2)	66	11	35.2	2.23	Belfast	59	23	40.3	
Manhattan (3)†	64	10	35.6	2.47	Cornish	59	12	37.2	5.24
Mankato	56	8	33.0	0.08	Fairfield	58	12	36.2	5.13
Marmaton	71	13	39.9	1.77	Farmington	26*	35	51.2	4.52
McAllaster	65	4	36.4	0.05	Port Preble				8.85
McPherson					Kennebunk Arsenal	59	15	37.3	5.48
Minneapolis	60	10			Cornell Hill	59	16	38.3	4.85
Monument	60	10			Lewiston	58	17	36.8	6.25
Morse	8	35.2	2.50		Mayfield	55	10	32.8	5.39
Oakley	63	14			Orono	59	19	36.6	4.50
Oberlin					Fallston	64	26	44.3	8.13
Offerle	70	10	34.9	0.56	Fort McHenry	70	25	47.7	6.03
Ogallala	63	15			Frederick	70	27	45.3	6.33
Quinter	60	7	38.2	0.37	Gaithersburg	24	40.8		
Richfield	70	20	40.0	0.22	Cumberland (1)	69	20	41.8	5.34
Rome	74	15	40.4	0.52	Cumberland (2)	76	20	46.6	4.42
Russell	58	12			Fallston	64	26	44.3	8.13
Salina					Charlevoix	55	29	47.3	5.27
Sedan	76	16	40.7	2.23	Frederick	70	27	45.3	6.33
Seneca	64	7	35.4	1.12	Gaithersburg	24	40.8		
Shields	62	12	35.0	2.48	Cumberland	66	20	41.8	5.34
Tribune	60	14	35.0	0.25	Clinton	55	10	34.7	4.17
Victoria	68	15			Colon	58	14	35.5	4.10
Wakefield					Columbiaville	58	10	37.6	2.25
Wa. Keeney	64	17	39.3	1.05	Crawford				2.97
Walker	64	12			Flint	58	8	37.3	2.99
Wallace					Fort Brady	53	10	32.7	1.75
Westkan	64	22	35.9	0.30	Calumet	55	12	36.6	1.68
Wilson	60	13	39.5	2.13	Cassopolis	58	18	37.7	4.38
Winona	68	15			Caldwell	50	8	33.4	2.82
Yates Center	65	12	37.9	2.15	Charlevoix	55	17	36.3	2.84
Kentucky.					Birmingham	61	13	39.5	3.37
Ashland	16*	40.8	4.03		Bronson	58	14	34.6	3.02
Bowling Green	76	19	48.1	7.90	Buchanan	56	10	37.9	5.60
Burnside					Calumet	55	12	36.6	1.68
Caddo					Cassopolis	58	18	34.9	4.38
Catlettsburgh					Caldwell	50	8	33.4	2.82
Canton	74	21	43.8	6.98	Charlevoix	55	17	36.3	2.84
Earlington	70	21	45.2	7.43	Benton Harbor	62	21	42.4	3.78
Eddyville					Berriens Springs	56	18	38.5	4.03
Falmouth	70	15	41.3	5.84	Big Rapids	56	0	36.9	2.34
Frankfort	1				Birmingham	61	13	39.5	3.37
Frankfort (2)	78	16	42.5	6.82	Bronson	58	14	34.6	3.02
Franklin	78	22	46.4	7.13	Buchanan	56	10	37.9	5.60
Greensburg					Calumet	55	12	36.6	1.68
Louisiana					Cassopolis	58	18	34.9	4.38
Millersburgh	72	19	46.6	6.21	Caldwell	50	8	33.4	2.82
Mount Sterling	71	17	41.6	4.63	Charlevoix	55	17	36.3	2.84
Murray	65*	18	44.0	4.92	Benton Harbor	62	21	42.4	3.78
Newport Barracks	71	14	42.0	6.28	Berriens Springs	56	18	38.5	4.03
Owenton	72*	10	40.7	6.64	Big Rapids	53	11	37.6	1.41
Peducah					Bronson	58	14	34.6	3.02
Pellville	85	17	48.2	6.09	Buchanan	56	10	37.9	5.60
Princeton	65d	20	43.4	7.43	Calumet	55	12	36.6	1.68
Richmond	75	17	44.3	4.32	Cassopolis	58	18	34.9	4.38
Shelbyville	75	16	42.4	6.73	Caldwell	50	8	33.4	2.82
South Fork	74	25	44.8	3.50	Charlevoix	55	17	36.3	2.84
Springfield					Benton Harbor	62	21	42.4	3.78
Williamsburgh					Berriens Springs	56	18	38.5	4.03

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean			Max.	Min.	Mean	
Massachusetts—Con.	0	0	0	In.	Lowell (1)	33	34	57.5	3.19	Lowell (2)	64	19	41.7	6.94
Alexandria	34	30	55.2		Lowell (3)	66	16	42.0		Lathrop	55	15	37.2	2.34
Baton Rouge	34	26	59.0		Ludlow	68	13	42.6	6.13	Madison	59	12	35.4	2.49
Cameron	33	28	56.2		Lynn	62	20	43.5	6.05	Manchester	53	12	37.6	2.78
Chataignier	36	32	56.2		Mansfield	55	15	41.2	6.50	Marshall	53	12	37.6	2.78

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.				
	Max.	Min.	Mean			Max.	Min.	Mean					
Missouri—Cont'd.	0	0	0	Ins.	N. Hampshire—Con.	0	0	0	Ins.				
Fayette	70	11	39.4	3.24	Berlin Mills	58	0	40.4	3.92				
Frankford (1)*	61	6	36.0	4.73	Concord	66	16	40.4	4.98				
Glasgow	70	10	38.4	2.66	Hanover (1)	57	12	36.8	4.76				
Grand Pass	69	12*	38.6	2.80	Hanover (2)	59	4	37.4	4.51				
Harris	60	8	35.6	2.07	Manchester (1)	64	16	40.8	5.23				
Harrisonville*	69	12	36.8	2.92	Manchester (2)	62	17	41.9	5.68				
Hermann†					Nashua*	65	15	41.3	5.65				
Ironton*	70	16	42.8	5.50	Newton	67	17	39.8	7.07				
Jefferson Barracks	72	14	42.8	3.75	North Chesterfield	56	7	33.5	5.81				
Kansas City	68	10	39.1	2.87	North Conway	60	13	37.7	5.42				
Lamont*	70	10	42.8	1.80	North Sutton				3.74				
Louisiana Bridge†					Plymouth	58	16	36.9	4.66				
Marshfield	60	25	40.8	...	Shaker Village	60	15	36.5	4.13				
Miami	68	10	35.2	...	Stratford	65	13	38.2	3.66				
Nevada				3.44	Walpole	62	13	37.3	5.67				
New Frankfort*	58	12	38.0	3.25	West Milan	63	18	35.1	4.07				
New Haven*	66	17	42.0	3.88	<i>New Jersey.</i>								
Oak Ridge*	68	22	43.0	4.30	Allaire	68	18	45.3	...				
Ozark*	65	16	41.4	...	Asbury Park	62	23	45.6	5.80				
Princeton*	63	10	39.8	3.35	Belleview				11.45				
Saint Charles (1)					Beverly†	67	21	44.9	8.16				
Saint Joseph†					Billingsport L. H.*	66	26	46.2	...				
Sedalia	72	9	41.5	1.99	Bridgeton*	65	28	44.4	7.99				
Steelville	78	16	41.6	2.84	Cape May C. H.	69	25	49.6	...				
Warrensburgh*	66	11	36.7	1.36	Egg Harbor City	66	19	45.4	7.71				
Warrenton*	15	39.9	...	Freehold	66	20	45.0	7.26					
Willow Springs†	75	15	43.0	5.43	Gillette	65	17	44.4	10.19				
Wither's Mill†				Hanover	60	13	40.5	10.72					
<i>Montana.</i>													
Camp Poplar River	63	—23	24.3	0.19	Highland Park	66	20	45.0	7.97				
Custer†				Hopewell									
Fort Assiniboine	63	—14	32.2	0.20	Imlaytown*	65	22	45.4	7.19				
Fort Custer	64	6	32.6	0.12	Jersey City	64	29	46.4	...				
Fort Keogh	65	—3	29.4	0.35	Junction								
Fort Logan†	55	—25	30.0	0.15	Lambertville*	64	28	46.4	8.24				
Fort Maginnis	67	5	34.8	0.92	Locktown	63	20	43.2	9.66				
Fort Missoula	59	—20	28.7	1.21	Madison	64	17	43.7	10.20				
Fort Shaw	67	4	37.3	0.18	Moorestown*	66	23	44.8	7.02				
Galpin†				Newark	66	25	45.6	8.87					
Glendive†	64	—14	27.4	0.06	New Brunswick (1)	65	27	48.9	...				
Kintyre				New Brunswick (2)	65	21	45.7	8.37					
Powder River†	62	—3	28.7	0.14	Ocean City*	64	27	47.4	8.79				
Virginia City	52	7	29.8	0.40	Plainfield	66	18	44.9	11.13				
<i>Nebraska.</i>													
Alliance†	78	0	34.1	...	Readington*	72	26	48.9	...				
Ansley†	74	3	32.2	0.80	South Orange	65	20	44.3	11.37				
Ashland	58	8	35.2	1.71	Tenafly	74	13	43.6	9.32				
Craig	60	5	32.3	2.16	Trenton*	64	30	45.0	7.75				
Creighton†	58	0	28.3	0.71	Union*	64	23	44.1	10.56				
Culbertson (1)†				Woodbury	66	26	47.1	9.44					
David City†	60	0	24.0	1.30	<i>New Mexico.</i>								
Do Soto*	56	7	33.2	1.38	Chama								
Fairbury	57	10	0.66		Coolidge	60	6	37.6	1.60				
Fairfield	52	7	1.80		Deming*	76	30	52.4	0.80				
Falls City†	51	20	38.1	0.75	Fort Bayard	72	18	45.1	...				
Fort Niobrara	64	—12	28.1	0.60	Fort Marcy	61	9	33.1	0.23				
Fort Omaha	60	4	33.7	1.40	Fort Selden	77	17	45.8	0.67				
Fort Robinson	67	0	32.4	0.36	Fort Stanton	67	8	38.4	0.89				
Fort Sidney	65	0	32.9	0.00	Fort Union	58	8	31.4	0.45				
Franklin*	64	—4	28.8		Fort Wingate	70	2	37.7	0.47				
Fremont*	58	7	33.1	0.28	Gallins Springs†	64	12	40.5	1.85				
Grand Island	60	0	25.4	0.75	Hillsborough†	70	14	42.0	1.20				
Grant	55	—5	28.0		Las Vegas†	60	6	34.5	?				
Genoa†	56	1	32.1	1.30	Lordsbury*	70	28	45.8	0.03				
Gering†	65	6	33.6	0.26	Lordsburg*	66	20	45.8	0.75				
Hay Springs†	64	—6	28.0	0.26	Las Lunas†	68	26	39.3	0.00				
Howe	56	8	36.8	1.00	Nogal†								
Kennedy†	68	0	36.1	1.10	Red Cañon								
Lexington*	63	3	33.6	0.35	Roswell &	58	12	32.7	2.90				
Marquette (1)				Springer†									
Minden	65	0	32.2	1.50	<i>New York.</i>								
Nebraska City	64	5	34.9	0.74	Adelphi Academy (Brooklyn)	64	31	47.4	...				
North Loup†	58	2	31.4	0.69	Alfred Centre	58	14	35.9	3.48				
Oakdale	60	0	26.2	0.78	Angelica†	59*	8	38.1	4.27				
Palmer	62	0	30.5	1.60	Ardenia*	63	25	44.7	8.24				
Plattsburgh†				Auburn	66	24	41.8	6.07					
Ravenna	65	4	32.6	0.95	Boyd's Corners	63	24	44.6	...				
Sargent	—3	—		Canton†	70	18	40.8	3.83					
Baronville	55	2	29.9	0.72	Carrollton	68	12	45.3	0.37				
Syracuse*	61	9	35.5	0.42	Celina	64	20	42.3	0.15				
Tecumseh†	55	9	34.9	0.60	Circleville (1)†	53	8	42.9	0.19				
Weeping Water*	63	2	31.7	2.62	Circleville (2)								
West Hill	60	0	30.8	1.50	Clarksville	71	17	40.0	5.01				
Weston	65	11	31.0	0.42	Cleveland	66	18	42.3	3.59				
West Point	71	15	—	Constableville*	57	10	35.6	10.00					
<i>Nevada.</i>													
Battle Mountain*	59	23	40.1	0.00	Cooperstown*	57	14	37.7	3.50				
Beowawe (1)*	53	18	36.6	0.05	David's Island	63	22	44.1	9.79				
Brown's*	71	18	43.5	0.15	Eden*	63	18	40.0	4.86				
Carlton*	56	10	35.8	0.40	Elmira†	61	16	42.0	4.19				
Elik*	56	18	35.6	0.51	Factoryville†	60	15	39.1	5.90				
Fenelon*	60	20	37.9	0.30	Fleming*	59	16	39.3	4.35				
Golconda*	76	22	44.6	0.05	Hess Road Sta†	62	18	39.8	15.23				
Hawthorne (1)*	68	25	45.5	0.00	Honeymead Brook*	63	11	40.0	4.88				
Hot Springs (1)	65	10	37.4	0.00	Humphrey†	60	19	39.8	4.51				
Humboldt (1)*	63	15	39.7	0.10	Iliion†	58	14	40.3	3.94				
Palisade	58	17	38.9	0.36	Ithaca	60	14	40.0	3.35				
Reno*	60	19	39.0	1.10	Lyon*	70	22	40.9	3.90				
Tecoma*	55	20	36.6	0.40	Lord Wadsworth	64	21	44.8	9.11				
Toano*	58	12	35.7	1.52	Geneva	61	19	41.1	4.35				
Wadsworth*	65	18	42.9	0.55	Hess Road Sta†	62	18	39.8	15.23				
Winnemucca*	53	15	35.5	0.10	Honeymead Brook*	63	11	40.0	4.88				
<i>New Hampshire.</i>													
Antrim													
Berlin Falls	54	1	33.1	...	Number Four†	55	5	33.7	5.26				

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
New York—Cont'd.	0	0	0	Ins.	New York—Cont'd.	0	0	0	Ins.
Balermo†	60	15	39.1	4.11	Palermo†				

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Pennsylvania—Con.	0	0	0	Ins.	Tennessee—Cont'd.	0	0	0	Ins.
Honesdale	61	14	41.2	5.31	Austin †	78 <sup>8</sup>	20	49.6	7.13
Huntingdon	65	17	40.6	5.65	Bolivar (2) †	74	20	49.2	0.70
Indiana	66	14	40.8	5.20	Brownsville †	78	26	50.8	8.20
Johnstown	67	19	41.4	5.33	Carthage †	.....	.....	8.04	.....
Kennett Square	.....	44.0	8.93	Charleston †	.....	.....	7.51	.....	
Lancaster	65	20	43.2	0.02	Clarksville †	75	22	46.7	7.22
Lansdale	.....	5.11	.....	Clinton †	.....	.....	7.61	.....	
Le Roy	57	14	35.1	5.80	Cog Hill	78	29	51.9	2.91
Lewisburgh	61	17	40.3	7.13	Columbia †	.....	.....	6.44	.....
Lewistown	52	20	39.1	4.09	Covington (1)	75	25	48.4	7.43
Lock Haven	63	13	43.0	6.96	Covington (2) †	74	25	46.2	6.15
Lock No. 4	56	19	41.5	5.96	Dunlap	73	24	51.4	7.22
Lynnpoort	65	16	42.4	5.50	Dyersburgh †	76	22	47.0	8.71
Mahoning †	.....	2.67	.....	Fayetteville	73	26	49.5	3.12	
Mauch Chunk	67	23	42.7	5.18	Florence Station	71	27	47.8	7.16
McConnellsburgh	66	23	41.4	6.51	Grand Junction †	77	20	48.3	6.74
Myerstown	58	28	41.5	9.99	Greenville	74	20	45.8	3.32
New Bloomfield	64	19	41.0	7.31	Grief	73	23	47.7	8.55
New Castle	68	18	42.4	2.89	Hohenwald	72	24	42.5	8.08
Nisbet	22	43.4	6.23	Jacksborough	70	21	46.5	6.23	
Oil City	.....	2.12	.....	Johnsonville †	.....	.....	8.12	.....	
Ottsville	.....	8.87	.....	Kingston (1)	75	25	45.6	6.65	
Parker's Landing	.....	4.00	.....	Leevile	75	23	47.4	7.35	
Pittsburgh	69	19	41.4	7.16	Lewisburgh	71	25	47.3	6.59
Philadelphia	65	28	45.0	.....	Loudon †	.....	.....	5.99	.....
Philipsburgh †	65	14	38.8	5.22	Lynnvile	64	20	45.6	7.66
Pleasant Mount	17	17	36.5	6.05	McKenzie	74	24	49.6	6.10
Point Pleasant	.....	8.63	.....	McMinnville	66	20	46.9	4.09	
Pottstown	64	22	46.0	5.50	Milan (1)	76	22	46.0	8.14
Quakertown	64	16	42.4	8.88	Milan (2) †	78	21	46.8	7.28
Reading	67	18	42.8	8.83	Springdale	75	22	47.3	6.00
Rimersburgh	64	16	39.4	.....	Strawberry Plains	68	18	39.7	4.20
Salem Corners	54	18	38.0	5.02	Tipton	65	20	40.9	6.12
Saltsburgh	.....	5.43	.....	Troy	55	16	39.9	5.84	
Seisholtzville	.....	9.70	.....	Tuscarora	64	23	43.7	6.66	
Selin's Grove	65	25	43.0	9.13	Uniontown	66	20	44.1	9.26
Smith's Corners	.....	9.06	.....	Warren	.....	3.53	.....	.....	
South Eaton	61	14	42.7	5.52	Wellsbrough	46	12	38.3	9.07
State College	60	17	39.5	6.48	West Chester	64	23	43.7	6.56
Swarthmore	66	22	44.3	6.74	Wilkes Barre	66	18	42.0	6.39
Tionesta	68	18	39.7	4.20	Wysox	60	13	39.0	5.02
Tipton	65	20	40.9	6.12	York	68	23	43.1	9.26
Troy	55	16	39.9	5.84	Rhode Island	.....	.....	.....	.....
Tuscarora	64	23	43.7	6.66	Bristol	61	23	46.8	6.01
Uniontown	66	20	44.1	9.02	Fort Adams	67	20	46.0	5.10
Warren	.....	3.53	.....	Kingston (1)	62	17	43.5	7.52	
Wellsbrough	46	12	38.3	9.07	Kingston (2)	63	16	42.8	7.38
West Chester	64	23	43.7	6.56	Lewistown	67	20	44.0	8.13
Wilkes Barre	66	18	42.0	6.39	Wysox	60	13	39.0	5.02
York	68	23	43.1	9.26	Rhode Island	.....	.....	.....	.....
South Carolina	.....	.....	.....	Aiken	75	24	55.4	6.01	
Allendale	78	22	57.0	8.88	Austin (1)	79	34	55.4	4.62
Batesburgh	78	23	54.7	3.64	Austin (2) *	78	34	55.8	.....
Blackville	78	24	56.5	2.80	Camp Eagle Pass	75	25	47.9	3.03
Branchville	50	19	56.4	1.96	Camp Peña Colorado	80	15	48.2	0.60
Cherwau	82	22	54.6	3.78	Childress	82	27	46.8	1.36
Chester	82	30	55.2	0.66	Columbia Station	80	30	56.6	4.92
Florence	80	34	56.4	4.11	Corsicana (2) *	76	26	52.2	8.66
Greenville	74	20	51.4	6.86	Cuero	88	30	60.7	4.60
Greenwood	76	22	53.3	3.56	Dallas (2) †	78	22	52.1	3.30
Hardeeville	82	24	57.8	2.56	Decatur	79	24	47.3	2.60
Jacksonborough	82	23	55.6	6.07	Duval *	80	32	54.6	4.85
Kingtree	80	30	56.5	4.00	Edinburgh	.....	.....	1.23	.....
Kirkwood	21	30	50.0	3.49	Epworth	74	26	44.2	1.24
Port Royal	78	23	59.4	5.44	Forestburgh	32	35	55.8	3.06
Saint Georges	80	24	55.8	4.00	Fort Bliss	76	24	48.5	0.28
Saint Mathew	84	24	56.3	2.98	Fort Clark	89	34	59.0	0.60
Simpsonville	81	20	50.5	2.68	Fort Davis	78	20	49.5	0.00
Spartanburgh (1)	78	18	49.6	5.52	Fort Elliott	82	15	41.6	0.73
Spartanburgh (2) †	78	24	53.4	5.88	Fort Hancock	80	13	43.0	0.00
Statesburgh †	77	25	54.3	2.80	Fort McIntosh	81	32	56.5	0.50
South Dakota	.....	.....	.....	Fort Ringgold	97	29	60.7	0.04	
Alexandria	58	—3	28.9	.....	Fredericksburgh	74	25	50.4	3.58
Canton	56	0	31.6	1.98	Gallinass	83	26	54.3	3.34
Clark	57	—5	27.9	.....	Graham	76	21	45.2	2.53
De Smet	65	—5	22.8	0.01	Hartley	80	8	35.2	2.30
Fort Bennett	64	7	23.9	1.40	Hearne	78	25	51.5	6.40
Fort Meade	64	—4	31.8	0.86	Houston	86	28	54.4	2.94
Fort Randall	62	—3	31.2	1.10	Panhandle	73	16	37.4	1.26
Fort Sully	65	—6	30.1	0.19	Pecos City	63	26	45.4	0.75
Kimball	56	—4	23.8	0.47	Round Rock	78	26	54.0	0.00
Onida	60	9	24.7	0.48	San Antonio	85	25	57.5	4.05
Spearsfish	66	3	33.2	0.48	Sugar Land	82	30	56.4	4.41
Wohler	60	—7	29.2	0.20	Tyler	82	26	51.2	10.49
Wolsey	60	—10	23.4	0.07	Waco (2) †	82	28	52.4	4.30
Woonsocket	68	—4	25.0	T.	Alta.	.....	.....	0.00	.....
Tennessee	.....	.....	.....	Beaver	65	12	35.3	0.14	
Arlington	87	21	45.5	5.98	Bingham	.....	.....	0.15	.....
Arlington	76	22	45.0	6.00	Blue Creek	59	23	38.3	0.60
Ashwood	72	25	47.2	7.39	Corinne	52	22	36.0	0.98
Fort Douglas	59	24	35.8	1.00	Fort Douglas	59	24	35.8	1.00

## Meteorological record of voluntary observers, &amp;c.—Continued.

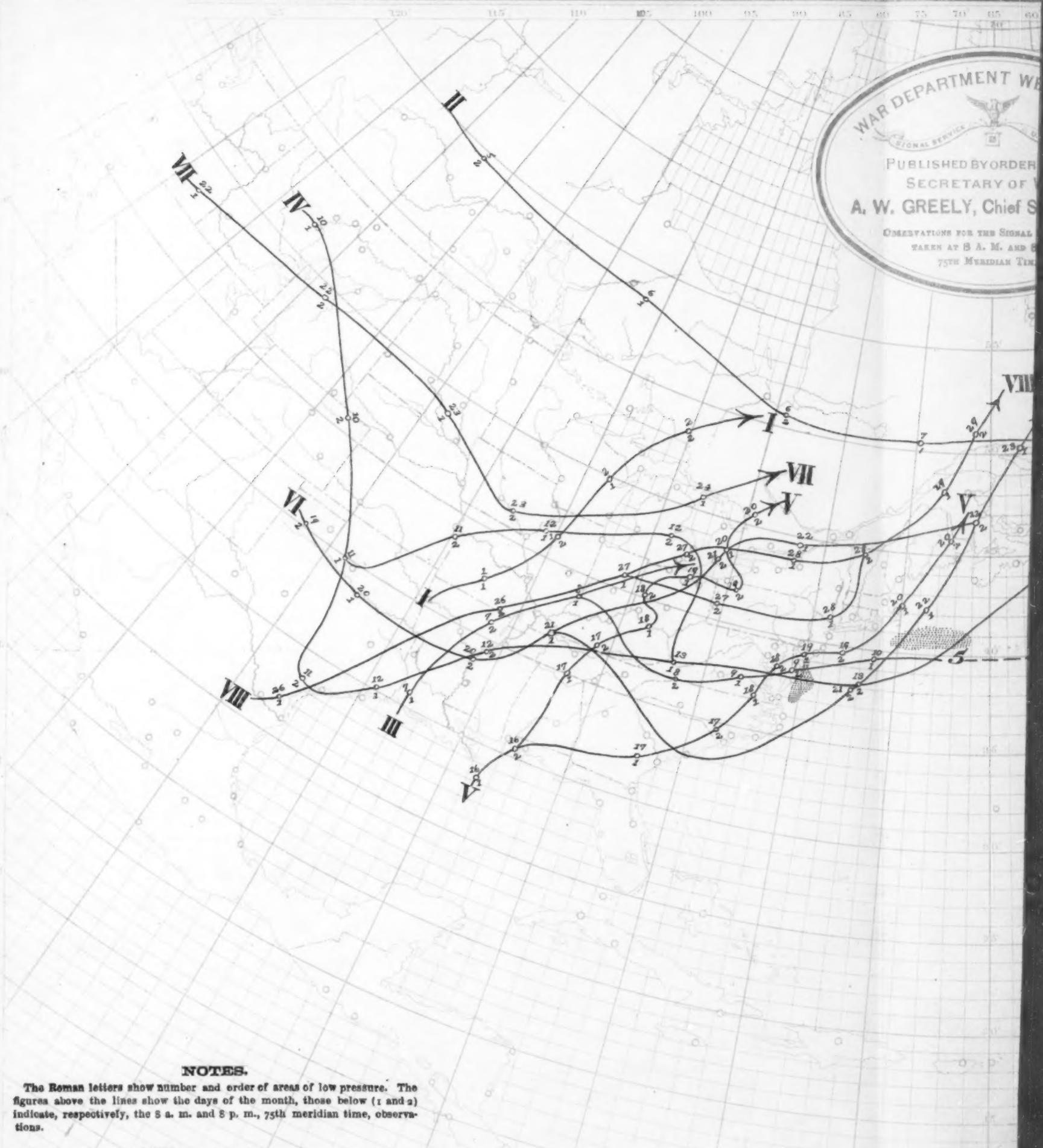
Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Utah—Cont'd.	0	0	0	Ins.	Fort DuChesne	55	4	29.6	0.05
Austin †	78 <sup>8</sup>	20	49.2	7.13	Kelton	56	16	35.1	0.11
Bolivar (2) †	74	20	49.2	0.70	Levan	.....	.....	1.34	.....
Brownsville †	78	26	50.8	8.20	Looseef	58	10	33.3	0.23
Carthage †	.....	.....	.....	Moab †	71 <sup>8</sup>	9	30.2	0.33	.....
Charleston †	.....	.....	.....	Mount Carmel †	74	14	33.4	0.78	.....
Clinton †	.....	.....	.....	Mount Pleasant †	47	8	27.7	0.76	.....
Clarksville	75	22	46.7	7.22	Nephi †	55	14	34.8	0.28
Craig	78	25	48.4	7.43	Ogden (1) *	56	20	37.9	0.79
Craig	78	25	48.4	7.43	Ogden (2) *	.....	.....	0.00	.....
Craig	78	25	48.4	7.43	Price	.....	.....	0.00	.....
Craig	78	25	48.4	7.43	Promontory *	60	18	35.8	0.17
Craig	78	25	48.4	7.43	Provo City	.....	.....	1.15	.....
Craig	78	25	48.4	7.43	Prov City	.....	.....	1.15	.....
Craig	78	25	48.4	7.43	Richfield	62	7	34.7	0.23
Craig	78	25	48.4	7.43	Saint George †	72 <sup>8</sup>	25	46.6	.....
Craig	78	25	48.4	7.43	Stockton	.....	.....	0.36	.....
Craig	78	25	4						

*Table of miscellaneous meteorological data for November, 1889—Signal Service observations.*

Table of miscellaneous meteorological data for November, 1889—Signal Service observations—Continued.

Stations and districts.	Elevation above sea level, feet.	Pressure, in inches.			Temperature of air, in degrees Fahrenheit.						Wind.			Temperature data since opening of station.																
		Mean actual.	Mean reduced.	Monthly range.	Monthly mean.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Least daily range.	Mean temperature of the dew-point.	Mean relative humidity per cent.	Precipitation, in inches.	Total movement, miles.	Maximum velocity.	Miles per hour.	Direction.	Date	Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	8 a.m. Average cloudiness, tenths.	8 p.m. Average cloudiness, tenths.	Length of record, years.	Absolute maximum.	Absolute minimum.	Year.
		Mean.	Mean.	Range.	Mean.	Mean.	Mean.	Mean.	Mean.	Mean.	Range.	Range.	Mean.	Mean.	Mean.	Miles.	Direction.	Date	Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	8 a.m. Average cloudiness, tenths.	8 p.m. Average cloudiness, tenths.	Length of record, years.	Absolute maximum.	Absolute minimum.	Year.		
Upper Miss. Valley.					35.6	2.3	35.6	35.6	34.4	21.4	3.7	4	20.5	77.0	0.97	+ 0.30	4,890	se.	26	13	5	13	104.9.5.1	18	74	1886	24	1875		
Saint Paul.	831	29.78	30.11.0.93	29.5—1.5	56	37.6	—4	21.4	31	23.8	32	5	23.5	78.4	1.98	+ 0.28	3,839	s.	26	13	7	10	95.0.4.3	18	70	1874	21	1875		
La Crosse.	744	29.33	30.16.0.99	32.0—2.0	57	40.3	5	23.8	32	2.17	+ 0.16	5,497	nw.	26	12	8	10	95.5.8.1	18	78	1888	3	1875							
Davenport.	615	29.46	30.14.0.95	35.6—1.4	58	43.5	5	29.7	27	25.0	77.0	6	23.2	70.4	1.29	+ 0.82	5,041	nw.	26	1	21	3	6	43.8.3.4	12	75	1888	9	1887	
Des Moines.	869	29.19	30.14.1.00	34.8—2.2	63	44.3	4	25.3	35	6	23.2	70.4	2.76	+ 0.55	3,757	nw.	23	23	7	10	74.8.4.1	17	72	1888	12	1872				
Dubuque.	651	29.40	30.13.1.00	34.8—1.2	60	41.9	5	26.7	32	26.8	85.2	1.57	+ 0.16	4,510	nw.	26	10	5	8	94.8.3.3	19	79	1888	3	1872					
Keokuk.	613	29.48	30.16.1.08	37.6—2.4	56	44.6	5	30.5	26	4	30.0	80.8	1.84	+ 0.16	4,405	nw.	26	17	8	14	120.0.6.1	18	81	1882	7	1872				
Cairo.	359	29.73	30.13.1.06	44.2—2.3	73	49.6	20	35.8	28	36.0	79.0	5.50	+ 1.50	5,900	n.	28	17	5	15	115.8.5.3	11	77	1887	4	1887					
Springfield, Ill.	644	29.43	30.12.1.05	35.2—3.8	59	44.4	7	31.9	25	4	31.2	80.4	4.05	+ 1.5	6,552	n.	31	16	17	20	94.8.3.3	19	79	1888	3	1872				
Saint Louis.	371	29.53	30.15.1.07	41.4—1.6	62	47.5	14	35.3	24	5	33.0	76.2	4.43	+ 1.56	7,555	nw.	36	22	10	5	15	116.0.6.0	19	82	1879	5	1872			
Missouri Valley.				32.7	2.3	32.7																								
Columbia.																														
Kansas City.	947	29.14	30.19.1.05	46.0—0.6	67	47.9	7	32.0	29	28.8	70.0	2.39	+ 0.28	4,803	nw.	24	8	14	6	10	94.6.4.4	2	78	1888	10	1886				
Springfield, Mo.	1,356	28.67	30.14.0.99	41.0—1.1	71	49.2	14	32.7	31	31.4	78.9	5.62	+ 0.21	7,043	n.	30	11	7	12	125.3.5.1	4	79	1888	8	1887					
Leavenworth.	842	29.27	30.18.1.06	39.2—2.8	67	45.1	10	30.3	35	4	26.2	74.8	2.77	+ 0.41	3,523	nw.	26	11	14	6	10	54.2.4.3	19	80	1887	4	1887			
Topeka.																														
Omaha.	1,113	28.97	30.19.0.99	35.3—2.7	60	43.9	7	26.7	29	2	24.5	73.4	0.87	+ 0.38	6,075	nw.	35	26	11	11	8	25.0.3.9	17	80	1887	14	1887			
Crete.																														
Valentine.	2,613	27.37	30.22.0.90	31.5—1.1	67	43.9	2	19.1	43	5	17.4	65.8	0.56	+ 0.26	7,133	w.	40	13	14	7	9	53.2.2.2	5	80	1888	32	1887			
Sioux City.	1,158	28.88	30.19.0.97	33.0—2.6	63	43.2	2	23.8	30	2	22.4	76.1	1.99	+ 0.22	6,507	nw.	32	13	10	9	64.5.3.2	1	58	1889	2	1889				
Fort Sully.	1,500	28.40	30.17.1.06	26.4—3.6	64	39.6	6	17.3	43	6	16.2	69.3	0.19	+ 0.30	5,484	n.	36	22	19	7	4	33.5.1.8	11	77	1887	27	1887			
Huron.	1,307	28.71	30.17.1.05	28.2—2.8	60	39.6	4	16.8	45	5	15.4	67.8	0.16	+ 0.41	7,547	nw.	36	29	13	13	4	43.7.2.8	9	76	1887	26	1887			
Yankton.	1,234	28.51	30.17.0.99	32.4—0.6	60	42.8	0	22.0	43	2	21.6	75.6	1.04	+ 0.41	5,390	n.	29	13	13	8	10	64.3.3.8	17	79	1888	18	1887			
Northern Slope.																														
Pt. Assiniboine.	2,690	27.22	30.13.0.89	29.0—0.0	63	40.7	—14	17.4	39	10	16.6	64.9	0.26	+ 0.49	8,621	sw.	45	26	16	5	8	54.3.4.3	10	71	1887	30	1887			
Fort Custer.	3,040	26.91	30.15.0.89	32.8—0.2	64	45.6	6	19.9	41	8	23.5	80.0	0.12	+ 0.26	4,845	se.	38	14	10	6	5	33.3.3.1	11	72	1885	24	1886			
Fort Maginnis.	4,340																													
Helena.																														
Rapid City.	3,260	26.68	30.18.0.83	32.8—2.8	72	44.6	0	21.1	44	10	17.0	60.4	0.32	+ 0.23	5,831	nw.	36	15	13	2	6	64.2.2.9	4	72	1889	22	1882			
Cheyenne.	6,105	24.06	30.23.0.60	30.2—3.8	61	40.0	1	20.4	36	6	14.3	60.4	0.56	+ 0.23	8,261	nw.	42	20	14	5	11	33.0.2.7	17	70	1887	20	1875			
Fort McKinney.	5,000	25.00	30.15.0.90	23.1—1.1	66	42.8	10	23.4	34	20.9	66.2	0.34	+ 0.21	6,302	w.	50	22	13	4	13	94.6.3.9	2	68	1889	2	1888				
Fort Washakie.	5,580	24.51	30.21.0.78	27.2—2.8	54	39.1	6	15.3	35	10	17.9	78.0	0.71	+ 0.21	2,918	sw.	37	22	15	13	2	33.5.2.7	3	60	1888	23	1882			
North Platte.	2,841	27.19	30.25.0.84	35.2—2.8	68	46.7	2	19.7	44	6	19.2	68.2	0.20	+ 0.16	6,110	n.	40	11	17	6	12	5.3.0.3.1	16	81	1887	25	1887			
Middle Slope.																														
Colorado Springs.	5,381	24.84	30.24.0.69	34.4—5.6	60	43.5	3	21.4	46	5	19.4	68.2	0.53	+ 0.18	4,905	s.	34	11	13	11	6	63.8.2.2	17	76	1876	18	1877			
Denver.																														
Pueblo.	4,753	25.34	30.26.0.76	33.0—2.8	61	43.2	1	22.9	38	4	24.6	80.5	0.73	+ 0.26	4,229	w.	45	11	7	6	54.4.1.1	2	72	1888	1	1889				
Concordia.	1,410	26.67	30.23.0.95	36.6—4.4	62	46.7	10	26.4	35	6	25.8	77.80	1.62	+ 0.73	4,553	s.	28	16	9	5	72.5.2.5	5	82	1887	15	1887				
Dodge City.	2,523	27.35	30.23.0.93	37.4—2.6	66	48.1	16	26.8	42	3	24.8	72.0	0.77	+ 0.22	5,805	n.	48	11	15	7	8	74.3.2.6	16	84	1888	13	1887			
Wichita.	1,366	26.69	30.19.0.97	39.4—2.8	67	48.7	15	30.3	33	4	28.2	74.4	1.14	+ 0.45	5,835	n.	25	11	13	9	8	64.6.3.5	2	78	1888	15	1889			
Fort Reno.																														
Fort Supply.																														

Chart I. Tracks of Areas of Low Press



NOTES.

The Roman letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (1 and 2) indicate, respectively, the 8 a. m. and 8 p. m., 75th meridian time, observations.

The dotted shading ( ) indicates fog belts.

The ruled shading ( ) indicates the position in which field-ice or icebergs were observed.

pressure. November, 1889.

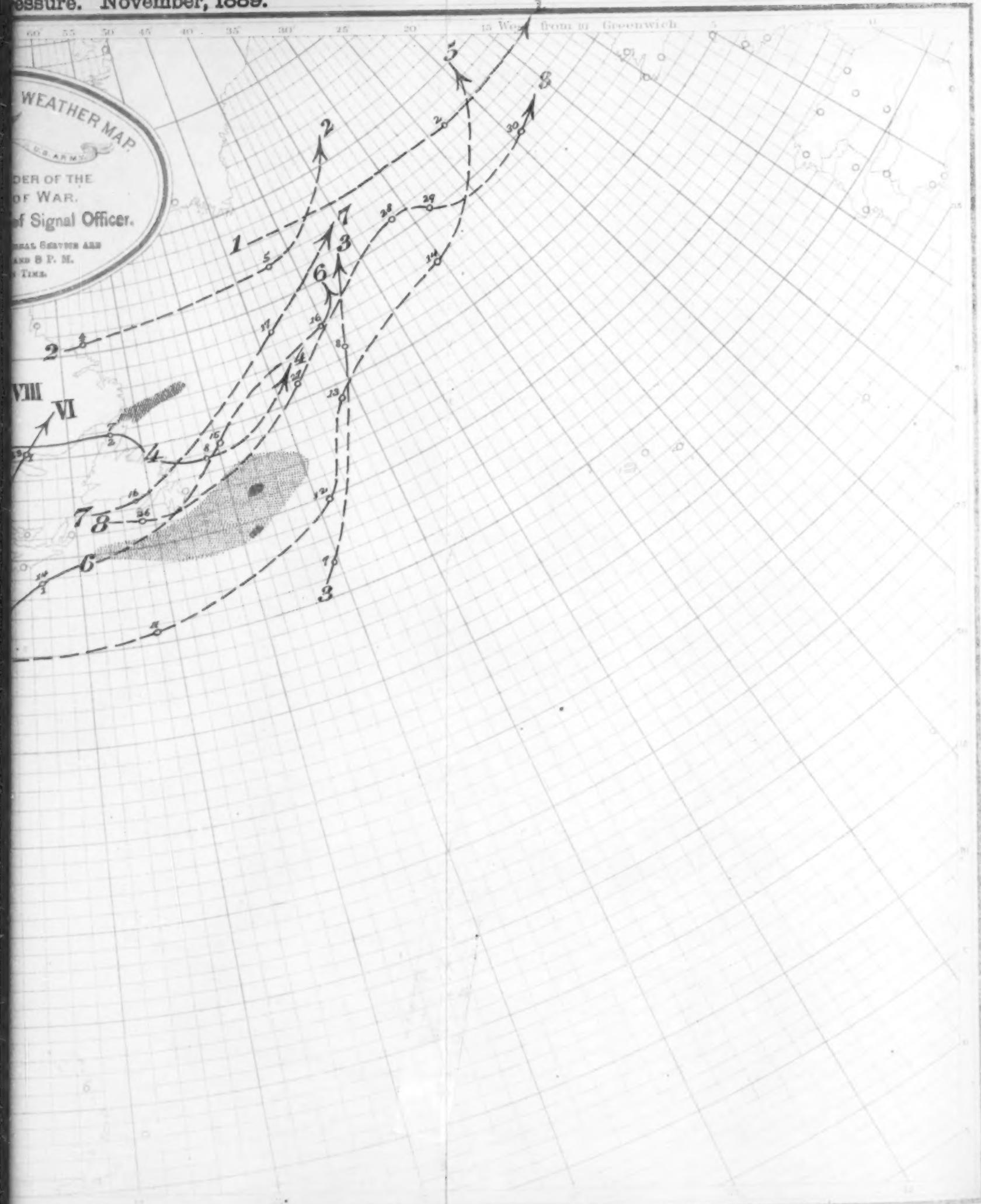


Chart II. Isobars, Isohyps, and Wind-s. November 1889.

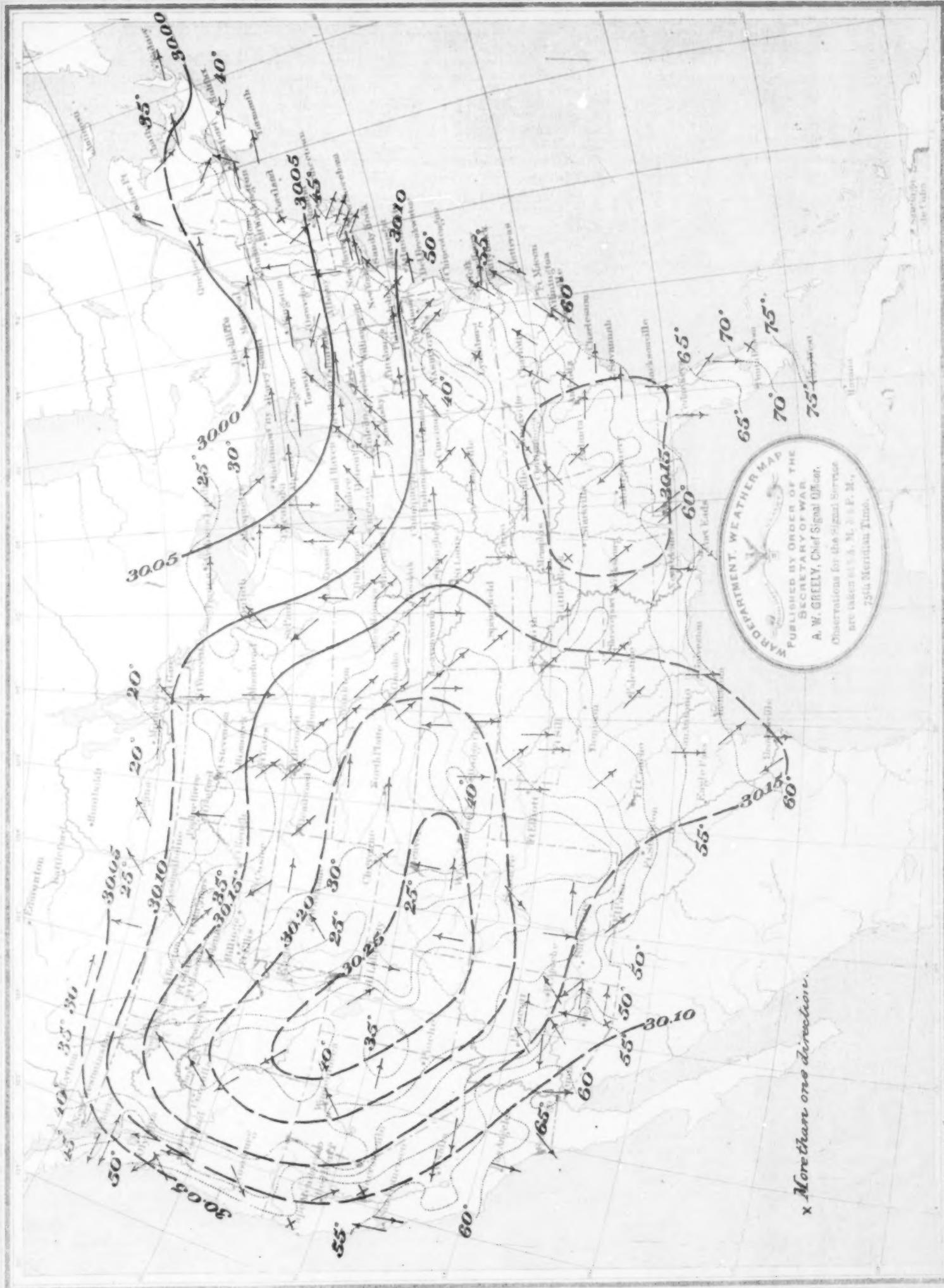
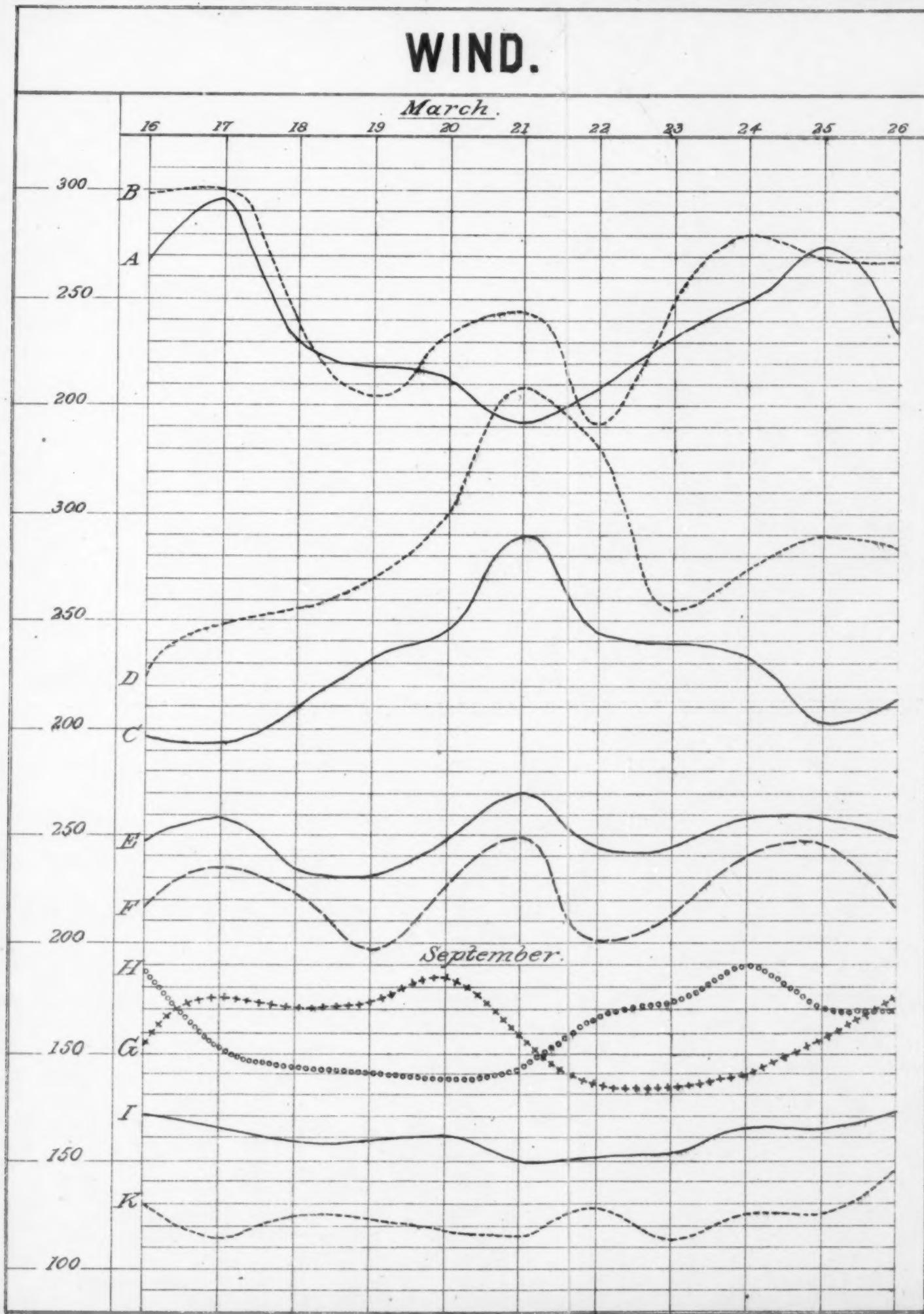


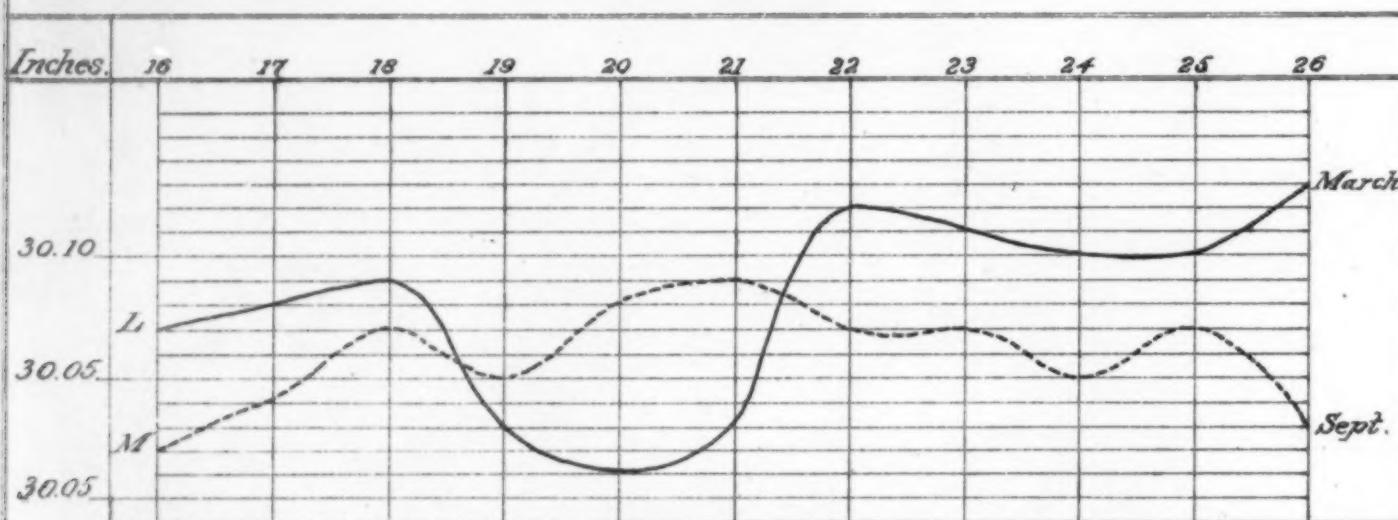


Chart V. Curves of Wind, Pressure, and Precipitation, and N

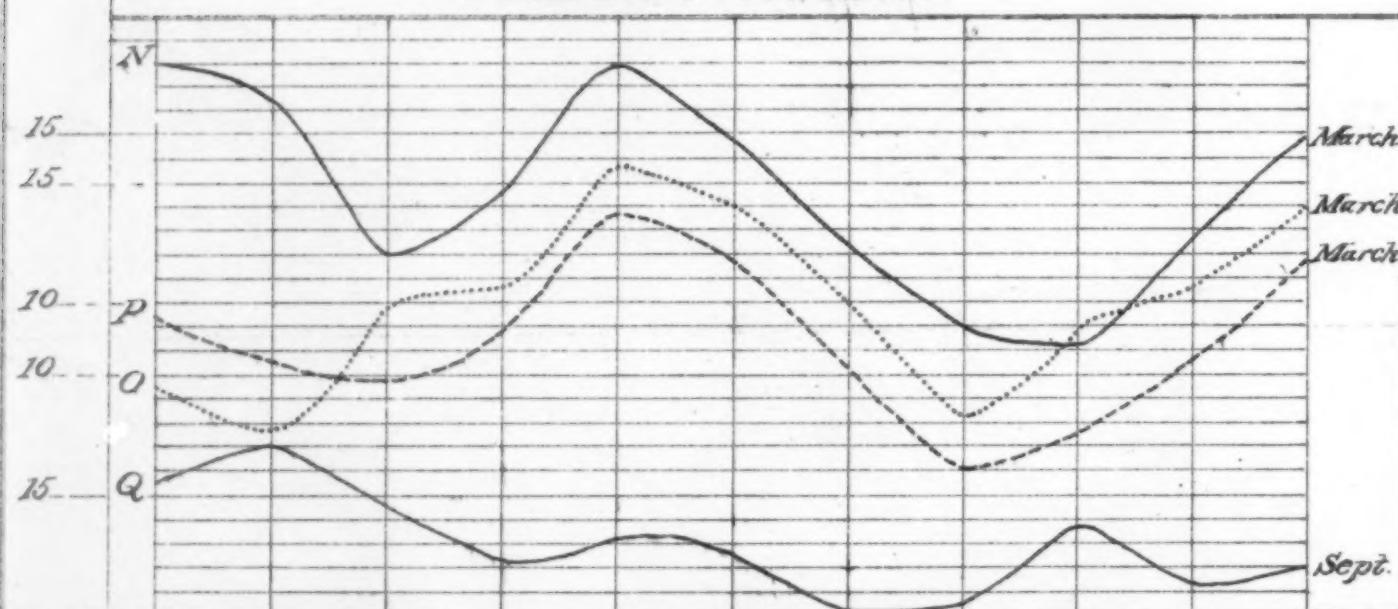


Number of Storms, in connection with Equinoctial Storms.

## PRESSURE.



## PRECIPITATION.



## NUMBER OF STORMS EACH DAY.

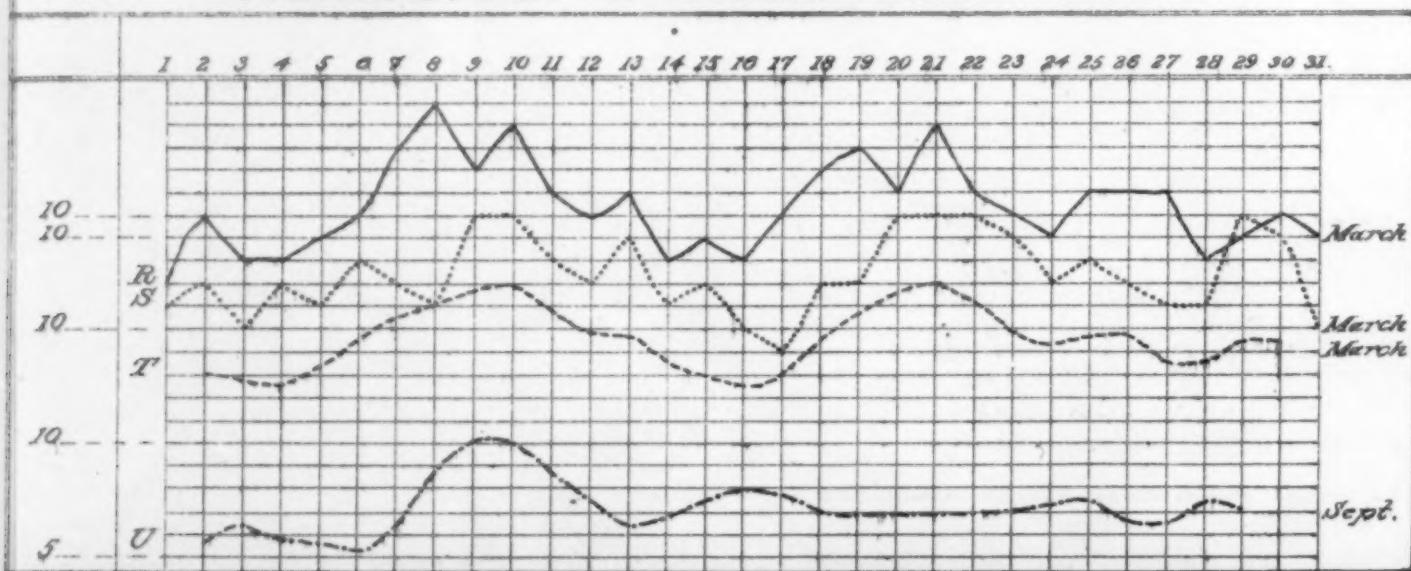


Chart II. Isobars, Isotherms, and Winds, November; 1889.

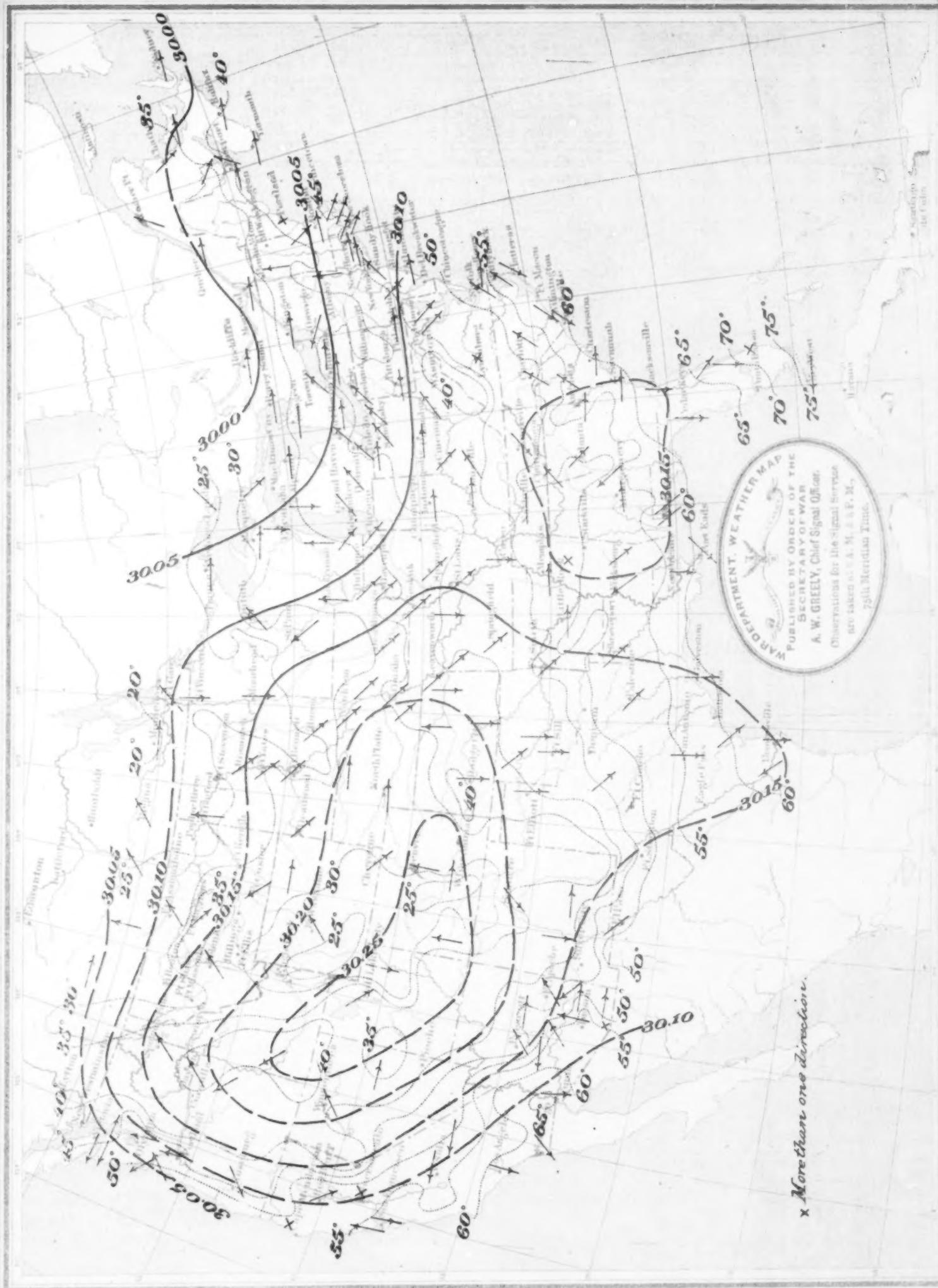


Chart III Precipitation. November, 1889.

Chart III Precipitation. November, 1889.

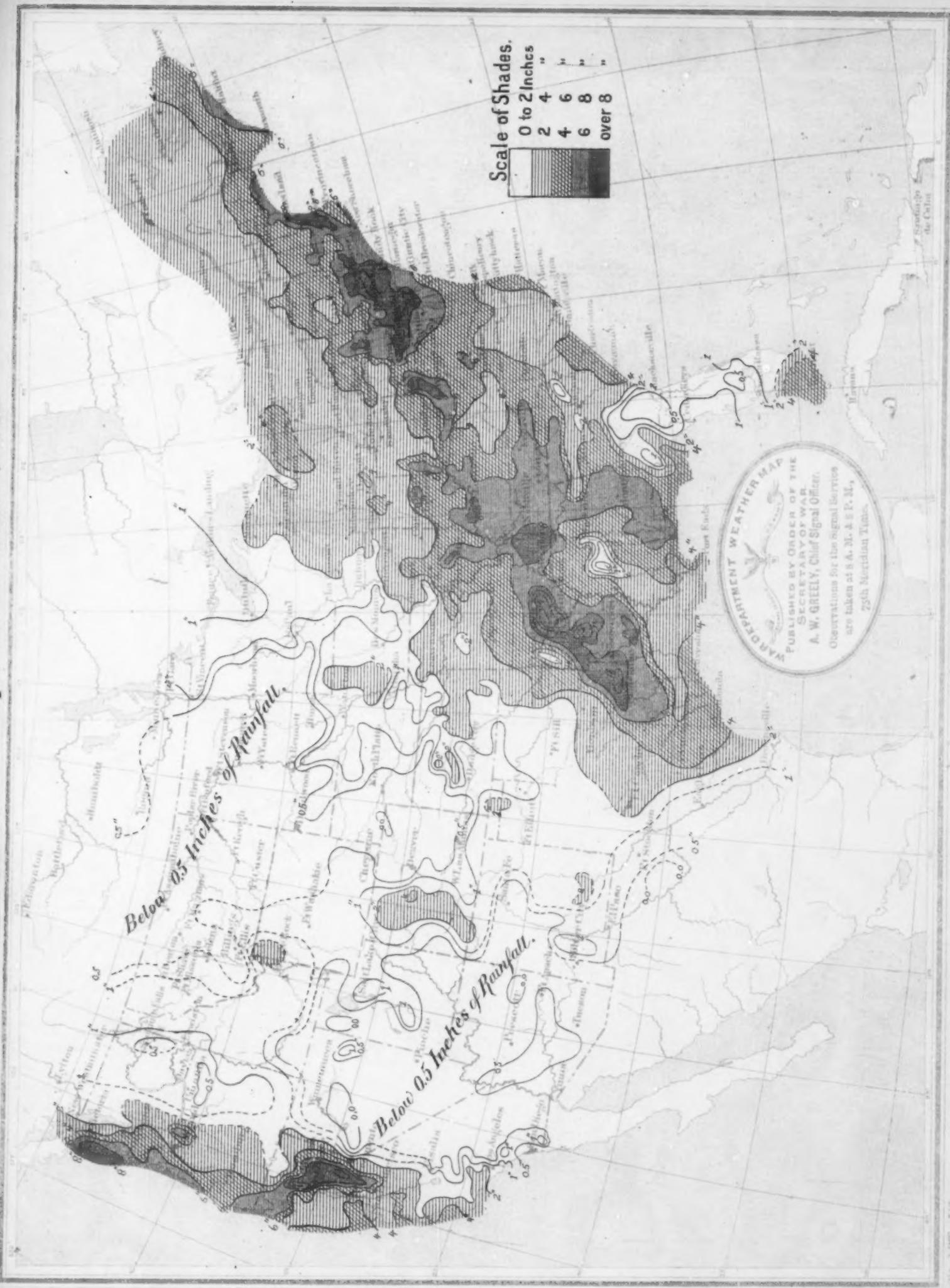


Chart IV. Depth of Snow (inches) reported on ground November 30, 1889, and Limits of Freezing Weather.



List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for the Monthly Weather Review. Reports have not been received from those marked with an asterisk (\*) in time to be used in the Review for November, 1889.

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.		
<b>ALABAMA.</b> Anburn, Ala. Weather Service. Bermuda, Wm. Fowler. Citronele, J. G. Michael. Columbiana, W. D. Lovett. Double Spring, A. M. Weiler. Livingston, Prof. J. W. A. Wright. Mount Willing, W. M. Garrett. Valley Head, E. P. Nicholson, M. D. Wiggins, M. D. Jones.	<b>DAKOTA.</b> Alexandria, L. C. Taylor. Brookings, Prof. Lewis McLouth. Canton, W. M. Cappett. Clark, W. H. Boals. Davenport, J. W. Leech. De Smet, Thos. H. Ruth. Gallatin, S. J. Pound. Huron, Dakota Weather Service. Kimbail, A. S. Stuver. Napoleon, J. H. Hoof. New England City, E. S. Clough. Onida, Mrs. M. F. Goddard. Roscoe, C. H. Spenser. Spearfish, J. H. Warren. Spring Lake, A. Gould. Steele, F. R. Hill. Wahpeton, C. I. Croft. Webster, Arthur Betts. Wolsey, G. W. Frink. Woonsocket, L. O. Libby.	<b>IOWA—Continued.</b> Independence, Emil F. Wulfke. Iowa City, Prof. A. A. Veblen. Jefferson, S. M. Taylor. Logan, Mrs. M. B. Stern. McCauley, Miss Ruby P. Barr. McGregor, A. F. Hofer. Manson, W. L. Thompson. Maquoketa, A. B. Bowers, M. D. Monticello, H. D. Smith. Mount Pleasant, Dr. Max E. Witte. Mt. Vernon, Prof. Alonso Collin. Muscatine, J. P. Walton. Osage, G. D. Patingill. Oskaloosa, Joseph Boyd. Sac City, Dr. Caleb Brown. Storm Lake, A. J. Bond. Vinton, T. F. McCune. Washington, Wm. A. Cook. Webster City, C. M. Trumbauer. Wesley, Wm. Ward. West Bend, Philip Dorweiler.	<b>MARYLAND—Continued.</b> Mt. St. Mary's, Mt. St. Mary's College. Woodstock, Woodstock College.	<b>NEBRASKA—Continued.</b> Fairbury, Dr. I. Humphrey. Falls City, A. B. Newkirk. Fremont, Isaac E. Heaton. Genoa, George S. Truman. Gering, Jno. P. Finley. Grant, G. W. Talbot. Holmesville, H. E. Sillik. Hay Springs, Wm. Waterman. Howe, G. D. Carrington. Kennedy, Mrs. M. G. Ericson. Kimball, D. Henderson, Jr. Lexington, J. M. Tipton. Marquette, John Ellis. North Loup, E. W. Black. Saronville, A. B. Holtenbeck. Syracuse, P. W. Risser. Tecumseh, W. L. Dunlap. Weeping Water, G. Treat.		
<b>ARIZONA.</b> Antelope Valley, Mrs. J. H. Hamilton. Ash Canyon, Jno. S. Robbins. Ash Creek, Jno. H. Hudson. Ash sprgs (Benson), J. D. Kinnear Banghart, Geo. Banghart. Bisbee, Rev. J. G. Pritchard. Buckeye, W. E. Hurley. Cedar Springs, E. E. Norton. Cooley's, C. E. Cooley. Chiricahua Mountains, D. D. Ross. Dos Cabezas, T. C. Bain. Dragoon, J. W. Graham. Eagle Pass, Dr. B. B. Tripp. Fairbank, S. W. Wood. Flagstaff, M. J. Riordan. Florence, A. T. Colton, C. E. Gila Bend, D. Murphy. Globe, J. H. Hamill. Holbrook, David Rose. Lochiel, Mrs. Alice F. Cameron. Mount Huachuca, J. W. Stump. New River, J. F. Singleton. Phoenix, S. H. Campbell. Seligman, R. O. Le Grand Signal, Henry Kosland. Strawberry, L. P. Nash. Teviston, Miss Mary Tovis. Tip Top, F. E. Wager. Tucson, Edward L. Wetmore. Volunteer sprgs, W. J. Hill. Walnut Grove, T. B. Carter. Williams, J. T. Ryan. Willow Springs, F. A. Chamberlin. Winslow, J. A. Scott.	<b>DELAWARE.</b> Kirkwood, Wm. Carnagy.	<b>FLORIDA.</b> Altamonte sprgs, M. E. Bingham. Alva, Chas. E. Robins. Archer, A. F. Wyman. Fort Meade, A. H. Adams. Homeland, J. S. Wade. Lake City, Dr. J. C. Neal. Madison, Livingston Vann. Manatee, Mrs. Mary W. Broberg. Matanzas, Mrs. B. E. Dupont. Merritt's Island, Rev. J. H. White. Tallahassee, Rev. Dr. W. H. Carter. Villa City, J. Emory Round.	<b>GEORGIA.</b> Andersonville, H. W. Bryant. Athens, Prof. L. H. Charbonnier. Diamond, Wm. Kimsey. Duck, A. L. Gillespie. Forayth, Thos. G. Scott. Gillsville, C. W. Meaders. Hephzibah, R. L. Rhodes. Marietta, G. S. Owen. Milledgeville, S. A. Cook. Monticello, G. F. Meriwether. Perry, C. H. Moore. Point Peter, C. M. Wether. Quinton, J. L. Cutler. Swainsborough, J. P. Pughley. Thomasville, C. S. Boudourant. Woolley's Ford, A. J. Julian.	<b>KANSAS.</b> Allison, John J. Cass. Bendena, G. Campbell. Cunningham, E. Shaw. Elk Falls, Dr. A. C. Williams. Emporia, Prof. T. H. Dinsmore, Jr. Englewood, C. D. Perry. Fremont, E. Atkin. Globe, Wm. Featherston. Havensville, L. W. Denen. Independence, J. M. Alstafer. La Harpe, Isaac S. Coe. Lawrence, Prof. F. H. Snow. Lebo, C. B. Jennings. Leoti, R. A. Ramey. Mackville, C. E. Poling. Manhattan, C. M. Breece. Mankato, E. H. Kern. Manhattan, C. P. Blachley. Morse, R. P. Edgington. Rago, D. S. Stratton. Rome, D. M. Adams. Salina, J. H. Gibeon. Sedan, J. W. Goodell. Topeka, Kansas Weather Service. Tribune, S. B. Jackson.	<b>MICHIGAN.</b> Benton Harbor, Dr. H. V. Tutton. Herrin Springs, F. A. Zerby. Birmingham, S. Alexander. Harrislake, Dr. D. W. Mitchell. Hudson, Major A. H. Boies. Kalamazoo, W. A. Black. Lansing, Dr. H. B. Baker. Lansing, Mich. Weather Service. Marshall, G. H. Greener, M. D. Mottville, J. A. Hartzler. Thornville, John S. Caulkins. Traverse City, S. E. Wait. Ypsilanti, C. J. Benitz. Ypsilanti, C. S. Woodard.	
<b>ARKANSAS.</b> Lead Hill, Silas C. Turnbow. Little Rock, Arkansas Weather Service. Winslow, Albert Dunlap.	<b>CALIFORNIA.</b> American Hill, T. L. Dwight. Anderson, Dr. A. Fouch. Arcata, H. L. Fry. Barstow, Geo. R. Gooding. Berkeley, Prof. F. Soulé. Camp, S. E. Gaskill. Centreville, Wm. Barry. Colegrove, Seward Cole. Crescent City, D. S. Shotwell. Evergreen, S. Holland. Ferndale, J. H. Frost. Georgetown, C. M. Fitzgerald. Grass Valley, C. F. Herriman. Hydesville, E. T. Foss. Iowa Hill, C. F. Macy. Jolton, T. T. Tidball. Julian, L. N. Bailey. La Grange, Jos. Dominica. Los Banos, A. Widmann. Mount Hamilton, Lick Observatory. National City, J. E. Boal. Needles, Chas. O. Johnson. Oakland, Dr. B. D. Trembley. Orville, Hiram Arens. Riverside, W. E. Keith. Sacramento, S. H. Gerrish. Salinas, Dr. E. K. Abbott. Santa Barbara, H. D. Vail. Santa Clara, A. Block. Santa Maria, L. E. Blochman. Sonoma, R. Hall. Steele's, A. T. Mason. Stockton, W. W. Trivett. Suisunville, T. B. Sanders. Taohy's, John Tuohy. Upper Mattole, W. H. Roseoe. Vacaville, G. O. Colton. Walla Walla Creek, J. Titcomb. Walnut Creek, J. L. Bancroft. Wheatland, W. J. Lombard. Willow, Davi. Bentley.	<b>IDAHO.</b> Era, Hervey Brooks. Kootenai, David McLaughlin. Lewiston, Robert Schleicher. Soda Springs, L. C. Eastman.	<b>ILLINOIS.</b> Aurora, W. Holden. Charleston, J. B. Dazey. Collinsville, Dr. J. L. R. Wadsworth. Louisville, E. E. Jenkins. Mattoon, Wm. Doster. Mount Morris, Wm. Feary. Owego, John S. Seely. Palestine, John E. Templeton. Peoria, Dr. Fred. Brendel. Philo, H. A. Burr. Riley, John W. James. Rockford, T. D. Robertson. Sandwich, Dr. N. E. Ballou. South Evanston, Dr. M. D. Ewell. Springfield, Ill. Weather Service. Sycamore, Roswell Dow. Windor, A. H. Hatch.	<b>KENTUCKY.</b> Ashland, J. M. Ferguson. Bowling Green, M. H. Crump. Caddo, H. B. Bonar. Canton, C. H. Major. Earlington, J. B. Atkinson. Falmouth, F. G. Held. Frankfort, E. C. Went. Franklin, T. W. MacGill. Louisville, Ky. Weather Service. Millersburg, Rev. C. Pope. Mount Sterling, H. C. McKee. Murray, J. P. Jones. Owenton, J. S. Cox. Pellville, Oscar Haynes. Richmond, Prof. O. A. Kennedy. Shelbyville, H. W. Prissler. South Fork, A. B. Gilbert. Springfield, W. U. Ray.	<b>LOUISIANA.</b> Cameron, Hon. S. P. Henry. Columbia, J. W. McGinnis. Grand Coteau, Rev. J. S. A. Raby, S. J. Houma, H. F. Belanger. Liberty Hill, E. A. Crawford. Luling, F. M. Rogers. Marksville, Leon Molenar. New Orleans, La. Weather Service. Point à la Hache F. C. Myers. *Winnfield, J. M. McCaig.	<b>MAINE.</b> Bar Harbor, Joseph Wood. Cornish, Silas West. Farmington, J. M. S. Hunter. Kent's Hill, W. C. Strong. Orono, Prof. M. C. Fernald.
<b>COLORADO.</b> Colorado Springs, Colo. W. R. Ser. Delta, J. A. Curtis. Denver, Rev. Wm. Forstall. Fraser, L. D. C. Gaskill. Fort Collins, Prof. L. G. Carpenter. Georgetown, W. A. Jayne, M. D. Greeley, E. Bethel. Palmer Lake, Thos. Gaddes, M. D. Rocky Ford, F. Watrous. Del Norte (San Luis Experiment Station), H. N. Griffin. Hartford, W. R. Matson. New Hartford, Rev. Wm. Goodwin. Southington, Luman Andrews. Voluntown, Rev. E. Dewhurst.	<b>INDIANA.</b> Amana, Conrad Schadt. Ames, J. Rush Lincoln. Bancroft, H. N. Redfrew. Belle Plain, H. W. Vandike. Blakeville, James Rogers. Carroll, Moses Simon. Carson, G. N. Ferguson. Cedar Rapids, H. D. Olds. Clarinda, A. S. VanSandt. Clinton, Luke Roberts. Cresco, Gregory Marshall. Des Moines, Adolphus Voegeli. Des Moines, Iowa Weather Crop Bulletin Service. Eagle Grove, C. A. Schaffer. Elkader, J. N. Hamilton.	<b>LOUISIANA.</b> Barren Creek Springs, Albert E. Aoworth. Cumberland, E. T. Shriver. Cumberland, H. Shriver. Fullerton, Prof. G. G. Curtis. Frederick, McClintock Young. Gaithersburg, J. T. De Sellum. Galena, Henry Parr. Gambrills, J. E. Moque. Jewell, Jos. Plummer. McDonogh, McDonogh Institute.	<b>MARYLAND.</b> Glendive, J. H. Ray. Fort Logan, Wm. Gaddis. Powder River, J. M. Graham. Sheldon, Sarah E. Sheldon. Virginia City, Eugene Stark.	<b>MONTANA.</b> Alliance, J. D. Sharts. Ansley, P. Fowle. Bingham, W. C. Wood. Creighton, George Roberts. Crotte, Nebr., Weather Service. Crete, G. I. Gilbert. De Soto, Chas. Seitz.		
<b>CONNECTICUT.</b>				<b>NEBRASKA.</b> Somerset, J. W. Thurber. South Canisteo, J. E. Wilson. South Kortright, D. C. Sharpe. Spencerport, F. A. Winne. Turin, R. T. Church. Utica, Thomas Birt. Wedgewood, O. F. Corwin. White Plains, Prof. O. R. Willis.		

*List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for Monthly Weather Review—Cont'd.*

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.		
<b>NORTH CAROLINA.</b> Asheville, Dr. Karl von Ruck. Chapel Hill, Prof. J. W. Gore. Grover, F. H. Dover. Lenoir, Dr. R. L. Beall. Mount Pleasant, H. L. T. Ludwig. Raleigh, Thos. C. Harris. Raleigh, North Carolina Weather Service. Scapstone Mount, H. L. Kimsey. Weidon, T. A. Clark. Ohio. Bellevue, Wm. Sheffield. Bement, P. W. Barton. Carrollton, P. M. Herold. Cleveland, G. A. Hyde. College Hill, John W. Hammitt. Collingwood, Wm. Smeed. Columbus, Ohio Weather Service. Demos, B. B. Ault. Elyria, C. W. Goodspeed. Garretttsville, S. M. Luther. Jacksonsborough, Dr. J. B. Bowsley. Kent, P. W. Eigner. Lepisic, J. D. Hadermann. Lordstown, W. S. Deen. Napoleon, Dr. T. C. Hunter. New Athens, Jos. Holmes. North Lewisburgh, H. D. Gowey. Orangeville, E. N. Hyde. Portsmouth, Dr. D. B. Cotton. Poland, Chas. Stewart. Salineville, J. W. Manning. Shanesville, John Roth. Shiloh, Peter Bowman. Tiffin, Rev. T. H. Sonedecker. Vienna, W. D. McCorkle. Wanseeon, Thos. Mikesell. Westerville, Prof. John Haywood. West Milton, Luke S. Motte. Yellow Springs, Miss Elias G. Rice.	<b>PENNSYLVANIA—Continued.</b> Blue Knob, A. H. Boyle. Catawissa, Robt. M. Graham. Corry, Wm. Loveland. •Drifton, H. D. Miller. Dyberry, Theo. Day. Easton, Dr. J. W. Moore. Edinburgh, C. F. Sweet. Franklin, Joseph Bell. Germantown, Thos. Meehan. Glencairn Hills, Nathan Moore. Haverford, H. V. Gummere. Le Roy, Geo. W. T. Warburton. •Meadville, David Logan. •Meshepaw, Stephen S. Jenkins. Nisbet, J. S. Gibson. Petersburgh, J. E. Rooney. Philadelphia, Pennsylvania Weather Service. Philipaburg, G. F. Dunkle. Pleasant Mount, J. D. Brennan. Quakertown, J. L. Heacock. Reading, C. M. Dechant. Salem Corners, T. B. Orchard, M.D. State College, Agricultural Experimental Station. Tipton, Miss C. J. Wilson. Troy, Rev. M. Gustin. Tuscarora, R. J. Mickey. Wellsborough, Hiram D. Deming. West Chester, Dr. Jesse C. Green.	<b>TEXAS—Continued.</b> Decatur, H. D. Donald. Duval, J. C. Edgar. Epworth, H. Graves. Fort Worth, Jas. G. Mallett. Fredericksburg, Arthur Strieger. •Gainesville, D. F. Ragdale. Gallinas, Lum Woodruff. Galveston, Tex. Weather Service. Graham, A. B. Gant. Hartley, C. F. Conklin. Hove, W. M. Smith. La Grange, Jos. Cottam. Lampasas, Dr. C. M. Madamell. •Merkei, J. L. Vaughan. Mesquite, Silas G. Lackey. Menardville, Louis Runge. New Braunfels, Paul Wipprecht. New Ulm, C. Runge. Pecos City, C. H. Merriman. Panhandle, J. L. Gray. Panter, E. H. Snider. Round Rock, W. Weiss. Silver Falls, C. M. Tilford. •Snyder, A. C. Wilmeth. Sugar Land, W. P. Martin.	<b>VIRGINIA—Continued.</b> Nottaway, Geo. Dunn. Petersburg, Jas. M. Colson, Jr. Richmond, W. H. Pleasants. Smithfield, J. R. Purdie. Spotsylvania, B. W. Jones. Summit, J. R. Sinn. University of Virginia, James Wearnouth. •Wytheville, Howard Shriver. WASHINGTON TERRITORY. Blakely, R. M. Hoskinson. Vashon, Mrs. C. B. Carpenter. WEST VIRGINIA. Clarksburgh, R. T. Lowndes. Eila, Henry Resseger. Kingwood, J. E. Murdoch. Pleasant Hill, D. Titchener. Seven Pines, J. R. Shaver. Rowlesburgh, M. J. Coniff. Tannery, G. H. Trembly. Tyler Creek, F. M. Swann.	<b>FOREIGN—Continued.</b> Killisnoo, Alaska, Jos. Zuboff. La Logia, Mexico, J. Byrnes. Leon, Mexico, Prof. M. Leah. Mazatlan, Mexico, Leon P. Acosta. Mexico, Mexico, Meteorological Observatory. Monterey, Mexico, Dr. Wm. De De. Montreal, Quebec, C. H. McLeod. New Westminster, B. C., Capt. A. Peele. Port au Prince, Hayti, Prof. I. Scherer. Pueblo, Mexico, Catholic Institute. Topolobampo, Mexico, Capt. Jno. Bell. New stations, November, 1889. Show Low, Ariz., Geo. M. Adams. Saches Ranch (Wilcox), Ariz., W. S. Saches. Tombstone, Ariz., C. S. Bogg. Los Gatos, Cal., F. H. McCullagh. Fruita, Colo., T. H. Green, M. D. Washington, D. C., Deaf & Dumb Institute. Ocala, Fla., D. S. Woodrow. Camilla, Ga., Frank M. Hull. Millan, Idaho, J. M. Wilson. Larrabee, Iowa, H. B. Strover. Gove, Kans., Jessie Royer. Princeton, Ky., Wm. Martindell. Leontown, Md., Geo. W. Joy. Manitowoc, Wis. Clasina Lips. Neillsville, W. Heaslett. Richland Centre, Dr. H. M. Ludwig. Summit Lake, E. S. Koepenick. Viroqua, F. J. Bold. Wauconta, G. H. Yapp. •Wauau, Hinemann Bros. Weston, C. R. Wilkinson. Waukeka, C. Rice.	<b>WYOMING.</b> Carbon, J. A. Shannon. •Evanston, Ira B. Moor. Lusk, F. S. Lusk. Saratoga, J. F. Crawford. •Wheatland, M. R. Johnston.	<b>FOREIGN.</b> •Burnside, S. A., Dr. C. J. Hering. Grand Turk, West Indies, Geo. I. Gibbs. •Guanajuato, Mexico, Meteorological Observatory. Hamilton, Bermuda, Gen. Russell Hastings. Havana, Cuba, Dr. Enrique del Monte.
<b>PENNSYLVANIA.</b> Albany, John Briggs. Bandon, Geo. Bennett. Beulah, T. L. Arnold. East Portland, Dr. Geo. Wigg. Ellensburg, Dr. F. S. Moore. Eads, Thos. Pearce. Grant's Pass, Jno. G. Jessup. Heppner, Arthur Smith. Jordan Valley, J. R. Blackaby. •La Grande, J. K. Romig. Mt. Angel, Rev. F. Barnatus Held. Portland, Oreg. Weather Service. Tillamook, A. P. Wilson.	<b>PENNSYLVANIA—Continued.</b> Austin, Oscar Samots. Austin, Q. C. Smith, M. D. Bear Creek Ranch, W. H. Potter. Benjamin, T. J. Kenan. Brazoria, H. Stevens. Brownwood, J. F. Mayo. Childress, G. H. Chipman. Cleburne, P. J. Norwood. •Coldwater, J. W. O'Brien. College Station, Prof. Duncan Adriance. •Colorado, Fred R. Blount. Corsicana, W. H. Hamilton.	<b>VERMONT.</b> Brattleborough, W. H. Childs. Burlington, W. B. Gates. East Berkshire, H. B. Lovering. Hartland, Rev. A. Hazen. Lunenburgh, Dr. Hiram A. Cutting. Manchester, Rev. E. P. Wild. Saint Johnsbury, F. Fairbanks. Stratford, H. F. J. Scribner.	<b>VIRGINIA.</b> Bolar, G. F. Eakle. Birdsneck, C. R. Moore. Christiansburg, H. D. Walters. Dale Enterprise, L. J. Heatwole. Lexington, Prof. H. D. Campbell. Liberty, W. N. Stone. Middletown, A. G. Prior. Mossingford, R. V. Gaines.	<b>FOREIGN.</b> •Burnside, S. A., Dr. C. J. Hering. Grand Turk, West Indies, Geo. I. Gibbs. •Guanajuato, Mexico, Meteorological Observatory. Hamilton, Bermuda, Gen. Russell Hastings. Havana, Cuba, Dr. Enrique del Monte.		
<b>PENNSYLVANIA.</b> Altoona, Chas. B. Dudley, M. D. Aqueduct, D. M. Sheeley. Blooming Grove, John Grathwohl.						

*Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for November, 1889.*

ALABAMA. Mount Vernon Barracks.	COLORADO. Crawford, Fort.	IDAHO. Boisé Barracks.	MARYLAND. McHenry, Fort.	NEBRASKA—Cont'd. Omaha, Fort.	NEW YORK—Cont'd. Willett's Point.
ARIZONA. Apache, Fort.	Lewis, Fort.	Sherman, Fort.	MASSACHUSETTS. Springfield Armory.	ROBISON, Fort.	TEXAS—Cont'd. Ringgold, Fort.
Bowie, Fort.	Logan, Fort.	ILLINOIS. Rock Island Arsenal.	Warren, Fort.	Sidney, Fort.	San Antonio, Post at.
Huachuca, Fort.	Lyons, Fort.	SHERIDAN, Fort.	MICHIGAN. Brady, Fort.	NEW MEXICO. Bayard, Fort.	OHIO. Columbus Barracks.
Lowell, Fort.			Mackinac, Fort.	Matney, Fort.	OREGON. Klamath, Fort.
McDowell, Fort.	Trumbull, Fort.	INDIAN TERRITORY. A. Lincoln, Fort.	Wayne, Fort.	Selden, Fort.	PENNSYLVANIA. Allegheny Arsenal.
Mojave, Fort.		Bennett, Fort.	MINNESOTA. Supply, Fort.	STANTON, Fort.	Frankford Arsenal.
San Carlos.		Buford, Fort.	MISSOURI. Snelling, Fort.	UNION, Fort.	RHODE ISLAND. Wingate, Fort.
Verde, Fort.		Meade, Fort.	JEFFERSON BARRACKS. Jefferson Barracks.	NEW YORK. Columbus, Fort.	Adams, Fort.
Whipple Barracks.		Pembina, Fort.	MONTANA. Assiniboine, Fort.	TEXAS. Davidis Island.	TEXAS. Bliss, Fort.
ARKANSAS. Hot Springs.	Little Rock Barracks.	Randall, Fort.	Custer, Fort.	HAMILTON, Fort.	BROWN, Fort.
CALIFORNIA. Alcatraz Island.		Bully, Fort.	Keogh, Fort.	MADISON BARRACKS. Niagara, Fort.	CLARK, Fort.
Angel Island.		Totten, Fort.	MAGNISSIS, Fort.	PLATTSBURGH BARRACKS. Porter, Fort.	DAVIS, Fort.
Benicia Barracks.		Yates, Fort.	MISSOULA, Fort.	SCHUYLER, Fort.	EAGLE PASS, Camp.
Bidwell, Fort.	DISTRICT OF COLUMBIA. Washington Barracks.		POPLAR RIVER, Fort.	WADSWORTH, Fort.	ELLIOTT, Fort.
Gaston, Fort.	FLORIDA. Presidio, San Francisco.		SHAW, Fort.	WATERVILLE, Fort.	HANCOCK, Fort.
Mason, Fort.	Barrancas, Fort.	JACKSON BARRACKS. Kennebec Arsenal.	NEBRASKA. Niobrara, Fort.	WEST POINT MIL. ACAD'MY. Peña Colorado, Camp.	MCINTOSH, Fort.
San Diego Barracks.	SCOTT FORTRESS BARRACKS.	PREBLE, Fort.			PEÑA COLORADO, Camp.